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REPORT OF COMMITTEE ON MILK

CONFERENCE OF STATE AND PROVINCIAL HEALTH AUTHORITIES OF NORTH AMERICA[1]

EARLE G. BROWN, M. D., *Secretary Kansas State Board of Health, Chairman*

(1) Inasmuch as the report of the Committee on Milk Production and Control, of the White House Conference on Child Health and Protection, is the result of an extended study and investigation of all phases of milk in its relation to the public health, including (*a*) its relation to communicable disease, (*b*) its public health supervision, (*c*) its nutritional aspect, and (*d*) its economic aspect, the committee is of the opinion that that report contains our present knowledge in relation to milk and milk control, and fairly represents scientific opinion on the subject.

Therefore the committee recommends the acceptance and approval of the entire report by the Conference of State and Provincial Health Authorities.

(2) Occasionally it becomes necessary for various reasons for and individual family to reduce expenditures. When such occasions arise the committee would warn against a reduction in the consumption of milk. The importance of milk in the national diet, particularly in the nutrition of children, must be constantly kept in mind; and we strongly advocate that milk consumption should be increased rather than reduced, even when it becomes necessary to readjust the family budget.

(3) The attention of the committee has been directed to two recently published papers, the apparent purpose of which is to attempt to prove that raw milk possesses a significant dietary superiority over pasteurized milk.

The first of these articles appeared in The Jersey Bulletin and Dairy World for February 11, 1931. It was entitled, "Ohio Tests Prove Natural Milk is Best," and was by Ernest Scott, M. D., and Lowell A. Erf. According to an editorial which accompanied the article, the work was carried on under the auspices of the National Applied Dairy Science Foundation, which is supported financially by such organizations as the American Jersey Cattle Club.

The paper reports experiments upon the feeding of white rats on raw certified milk, on raw milk from cows fed upon special feed,

[1] Washington, D. C., April 27-30, 1931.

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and on pasteurized milk. The following table is given as a summary of observations on the increase in the weight of the rats used in these experiments:

General summary

One hundred and forty-seven rats completing test; each experiment covered a period of five months, 1929–30

[Weight (average gain)]

	Number of animals	Initial	1 month	3 months	5 months
Control	28	40	152	187	210
Certified	18	42	115	153	185
Special raw	52	46	93	148	168
Special pasteurized	8	45	93	127	147
Commercial pasteurized	41	46	54	84	99
	147				

The following conclusions are drawn by the authors:

(1) These experiments tend to prove that the milk of cows fed upon a diet rich in minerals and vitamins is a more nutritious food than the usual commercial milk.

(2) Milk from properly fed cows that is subjected to heat loses its hematogenic and growth-promoting properties.

(3) Rats fed upon commercial pasteurized milk fortified by cod-liver oil and tomato juice failed to equal in growth and development rats fed upon the milk of cows given a diet high in mineral vitamins.

(4) The unpasteurized milk from cows fed upon the diet described in this report does not produce the anemia usually reported as occurring in the albino rat following an exclusive milk diet.

(5) The results of these experiments correspond closely with those obtained by Lewis and by Ladd, Evart, and Frank in their infant feeding experiments.

The committee desires to point out that in all but one of the four experiments which the authors report, the raw and pasteurized milk used for experimental purposes were not the same and were therefore not comparable. The raw milk was drawn from cows to whose regular feed had been added a "special complex mineral mixture, consisting of bone meal and other ingredients, and of dried fish meal consisting largely of fish liver and fish viscera." The pasteurized milk used was an entirely different milk, procured from a corner grocery store, was reported as having a slightly lower butter fat content than the raw milk, and was undoubtedly from cows which had not received the same special feed as above indicated. It would, therefore, be unscientific to draw any conclusions from these experiments with reference to the effect of pasteurization upon the nutritive value of milk. In order to draw valid conclusions it is necessary to use the same milk for both series of animals, making sure that the only difference between them is the factor of pasteurization. This was done in only one of the four experiments and the number of animals to which the pasteurized milk was fed in this case

was only eight, whereas the number of animals to which the corresponding raw milk was fed was 52. Such a sweeping conclusion as is contained in the title of this paper should not be drawn from experimental results upon only eight animals. In fact, the paper does not contain satisfactory evidence that the relatively slight difference between the average weights of the raw and pasteurized groups may not have been within the range of probable experimental error.

The second article appeared in The Lancet for March 21, 1931. It is by Mattick and Golding, of the National Institute for Research in Dairying, and is entitled, "Relative Value of Raw and Heated Milk in Nutrition."

The experiments reported in this paper were also upon rats. The rats were fed raw milk, milk which had been sterilized for 30 minutes at 210° to 212° F., milk which had been stored in a "cold cellar" for 24 hours and then sterilized for 30 minutes at 210° to 212° F., and milk which had been pasteurized for 30 minutes at 145° to 149° F. As a result of these experiments the authors formulated the following summary:

> A method is described by means of which it is demonstrated that raw milk with biscuit, made only from white flour and water, is capable of sustaining the growth and reproduction of rats. A fourth generation on this diet at the time of writing is as healthy and normal as the previous generations. Sterilized milk fed under similar conditions failed to sustain life and reproduction beyond the first generation, except on one occasion, when a second generation of very stunted animals was produced. Even the original rats (the first generation) failed in many instances to reach maturity.
>
> Preliminary experiments with pasteurized milk demonstrate results sufficiently marked to indicate that milk heated at a temperature of 145° to 149° F. for a half hour has undergone changes which have considerably reduced its dietetic value. The factors which are destroyed will form the subject of a future communication, but there are indications that the partial destruction of Vitamin B_1 must be included in the number.

The committee believes that the experimental results do not justify the conclusion that pasteurization is harmful, since the average weight of the six bucks fed pasteurized milk for four months was 235 grams, as compared with 256 grams for the six bucks fed raw milk, and since the average weight of the six does fed pasteurized milk for four months was 183 grams compared with 184 grams for the six does fed raw milk. The committee feels that these differences may not be justly termed significant.

The committee is advised, however, that in a number of States reprints are being prepared of such material as the above and distributed broadcast by the raw milk dealers in an effort to discredit pasteurized milk in the mind of the consumer.

It is highly important, therefore, that the public health officials be in position to furnish consumers with the results of other observations.

For this reason the committee is including in this report the following abstracts of other articles:

ABSTRACT OF REPORT OF THE GEORGE M. OYSTER, JR., BABY MILK PHILANTHROPY FOR THE FIRST EIGHTEEN MONTHS BEGINNING APRIL 24, 1911, AND ENDING OCTOBER 24, 1912, WITH OBSERVATIONS REGARDING THE RELATIVE NUTRITIVE VALUE OF PASTEURIZED AND RAW MILK FOR INFANT FEEDING.

One hundred and eleven babies were fed pasteurized milk exclusively and 208 babies were fed raw milk exclusively. The average net gain for all babies (both well and ill) receiving pasteurized milk was 0.4274 ounces per day. The average net gain for all babies (both well and ill) receiving raw milk was 0.4253 ounces per day.

Another group of 62 babies received both raw and pasteurized milk at different times. The average net gain made by these babies (both well and ill) while receiving pasteurized milk was 0.4457 ounces per day. The average net gain made by the same babies (both well and ill) while receiving the raw milk was 0.4440 ounces per day.

The results of either or of both observations above referred to would seem to indicate that no possible injury to the nutritive properties of milk for infant feeding results from modern, scientific pasteurization, and it must be concluded, certain possible risks can be eliminated through the careful pasteurization of milk that can not be so completely and safely eliminated in any other way.

ABSTRACT OF ARTICLE ENTITLED, "DEMONSTRATES FOOD VALUE TO BE EQUAL IN RAW MILK AND IN PASTEURIZED MILK," BY DR. J. M. BRANNON, NUTRITIONIST AND BACTERIOLOGIST, UNIVERSITY OF ILLINOIS. THE MILK DEALER, APRIL, 1930.

After two groups of rats were fed, one with raw milk and the other pasteurized milk (pasteurized under laboratory conditions) for several weeks, no difference was found between the two groups of rats. This work showed that so far as nutritional value is concerned there was no difference between the two types of milk.

The second experiment varied from the first in that commercial pasteurized milk was used rather than laboratory pasteurized milk. * * * The conclusion from both experiments is that raw milk and pasteurized milk are equal in nutritional value.

In experiment 3 * * * rats were divided into four lots and kept in separate cages; one lot was fed pasteurized milk only, the second lot was fed raw milk, the third lot was fed a mixed diet which was supposed to be complete in itself, plus raw milk, and the last lot was fed the same mixed diet plus pasteurized milk. The accumulated results of all three of these experiments indicate no preference for raw milk.

ABSTRACT OF REPORT TO THE LOCAL GOVERNMENT BOARD UPON THE AVAILABLE DATA IN REGARD TO THE VALUE OF BOILED MILK AS A FOOD FOR INFANTS AND YOUNG ANIMALS. JANET E. LANE-CLAYPON. M. D., DSc., LONDON. FROM NEW SERIES NO. 63. REPORT TO THE LOCAL GOVERNMENT BOARD ON PUBLIC HEALTH AND MEDICAL SUBJECTS, LONDON, ENGLAND.

After exhaustive analysis and review of the existing experimental evidence described in a 60-page report, the author comes to the following conclusion:

The balance of evidence, both experimental and clinical, points in the main to the same conclusion. Both lines of research show—

(1) That there is apparently no serious loss of nutritive value produced by feeding an animal upon boiled milk derived from an animal of the same species.

At the same time it must be pointed out that the public evidence on this point is scanty.

(2) That when an animal is fed upon the milk of another species, the milk from which has been found to be suitable for this purpose, such small differences as have been found in the nutritive value of raw and boiled milk have been in favor of boiled milk.

(3) That the milk of the same species has a considerably higher nutritive value for that species than the milk of any other species so far investigated.

ABSTRACT OF ANNOTATION IN "THE LANCET" FOR JANUARY 17, 1931, ON AN ARTICLE ENTITLED, "MILK CONSUMPTION AND THE GROWTH OF SCHOOL CHILDREN," BY G. LEIGHTON AND P. L. McKINLEY, EDINBURGH. H. M. STATIONERY OFFICE, 1930.

A test was conducted with 20,000 children attending schools in Lanarkshire. The heights and weights of all the children were measured by a special staff of doctors and nurses at the beginning of the feeding period and again at the conclusion of the experiment some four months later. The whole of the milk used was Grade "A" (tuberculin tested), one-half of it being given raw and the other half pasteurized. One-half of the children acted as controls, and the other half receiving three-fourths of a pint of either raw or pasteurized milk.

The results of the test support the conclusions reached by other workers—namely, that additional milk definitely accelerates the rate of growth as measured by increase both in weight and height. The differences between the milk groups and the control groups were small, as would be expected in a test lasting only four months. In most of the age groups the average increase in weight was 4 to 6 ounces more in the children receiving milk than in the controls, and the average increase in height was about one-tenth of an inch more in the milk groups. No significant difference was observed between the growth-promoting effect of raw and pasteurized milk.

The committee feels that the evidence contained in these articles is not entirely satisfactory and that there is need for further study of an authoritative type. It understands that the Public Health Service is contemplating the possible advisability of making a study to determine the present experience with reference to the feeding of infants with raw and pasteurized milk. It is understood that the proposed plan of work is to circularize the various State health departments with a request that arrangements be made whereby the public health nurses will make a survey of the present condition of infants of 2 years of age and under in their respective territories, securing information as to present weight, as to whether raw or pasteurized milk has been fed, as to supplementary feeding, and as to the frequency of illnesses.

The committee wishes to urge the Public Health Service to undertake such studies immediately, and to recommend to the Conference of State and Provincial Health Authorities that it support such studies by every means within its power. The committee believes that if it can be proved that the average American child which has been fed pasteurized milk shows about the same increase in weight and the same general state of health as the average American child which has been fed raw milk, this will be sufficient to convince the average American parent that the public health advantages of pas-

teurization may be utilized in infant feeding without dietary disadvantage. After all, what we are interested in, is the effect of milk upon human babies rather than the effect of milk upon the young of animals.

AN EPIDEMIOLOGICAL STUDY OF TYPHOID FEVER IN SIX OHIO RIVER CITIES[1]

By M. V. VELDEE, *Surgeon, United States Public Health Service*

The sanitary regulation and control of a public water supply has for its prime object the elimination, in so far as possible, of all water-borne diseases, particularly typhoid fever. The results following the inauguration of such control in cities wherein the water supplies were previously of poor quality and the typhoid rates were high are readily demonstrated. However, as the sanitary control becomes more nearly perfect, bringing the bacteriological quality of the water nearer to the usually accepted standards of purity, it becomes increasingly difficult to demonstrate the relationship between the public supply and the remaining incidence of typhoid fever. In fact, under such circumstances it is usually impossible accurately to evaluate the responsibility of the drinking water in the occurrence of the remaining cases. It is a matter of great importance to pursue field studies along this line whenever possible. Particularly is this true in cities which are compelled to draw their public water supplies from sources to which are continually being added greater and greater quantities of dangerous pollution. The necessity of future alterations in, or improvements to, the methods of sanitary control will, in such cities, be largely governed by the typhoid fever trends.

Certain of the smaller cities which border on the Ohio River make an excellent field laboratory for studies of this nature. Their water supplies come from the Ohio River, which is at all times so dangerously polluted that its use in the raw state has in the past invariably resulted in a high incidence of typhoid fever. Even with the present methods of efficient artificial purification the danger is ever present, since operative lapses may sometimes occur. How extensive such lapses could be before they would result in a discoverable increase in the typhoid incidence is problematic. Such knowledge is essential to the proper safeguarding of the community's health. It was the purpose of the study here reported to investigate carefully each current case of typhoid fever occurring over a considerable period of time and to examine into its possible relationship to any recorded deterioration in the bacteriological quality of the public drinking water.

The cities studied include East Liverpool, Steubenville, Ironton, and Portsmouth, Ohio; Wheeling, W. Va., and Ashland, Ky. The

[1] From the Stream Pollution Laboratory of the United States Public Health Service, Cincinnati, Ohio.

public water supply history of each of these Ohio River cities is essentially the same. For years the public supply was drawn from the river and delivered direct to the consumer without any form of artificial purification. In more recent years sanitary improvements have been installed from time to time until, for the years covered in the present epidemiological study, each of the six cities studied used modern methods of artificial purification.

METHODS OF STUDY

Bacteriological data.—The filtration plants in the six cities studied are provided with well-equipped laboratories, in which daily bacteriological examinations are made of the water in the various stages of purification. Prior to 1922 the chemist in charge of each plant very largely designated the details of the bacteriological methods to be used, and, due to minor differences in procedure, the reports from the six plants did not necessarily have the same weight. In 1922, Sanitary Engineer H. W. Streeter,[2] of the United States Public Health Service, in connection with his studies of water purification, effected, through the respective State health officers, a cooperative arrangement with each supervising chemist which assured the availability of uniform bacteriological data. Under this arrangement each chemist agreed to modify his methods where necessary so as to bring them in agreement with those used in the Stream Pollution Laboratory at Cincinnati,[3] and at the end of each month the plant operator submitted to the Cincinnati laboratory a detailed report of the bacteriological and chemical findings for that month. It was also understood that, if any significant lapse in the quality should occur, the Cincinnati laboratory would be notified at once. Careful checking at intervals has shown that uniformity of technique was satisfactorily established and maintained.

This uniform method of bacteriological analysis and reporting continued in effect from 1922 to the last of December, 1929, thus including the period of the present study. Because of the limited funds available, it became necessary to discontinue the cooperative arrangement with Ashland in 1925 in order to include Wheeling when the new filter plant was opened in the latter city. However, no changes were made in the routine methods at Ashland, and so the records from that plant continued to be comparable. Administrative difficulties in Steubenville made satisfactory plant operation extremely difficult at times, but this did not affect the character of the laboratory work.

Typhoid fever statistics.—The reporting of both cases of and deaths from typhoid fever is required by law in each of the six cities studied.

[2] Streeter, H. W.: Studies of the efficiency of water purification processes. Public Health Bulletin. No. 172.

[3] See appendix to Public Health Bulletin No. 172, p. 414.

The reporting of deaths is complete, and the only errors likely to have crept into the typhoid mortality statistics are those due to mistakes in diagnosis. One such error was discovered within the period of this study and very likely a few others did occur. The mortality records used in preparing the various tables were obtained by personally searching the original death certificates. Each city serves as the hospital and medical center for a considerable surrounding territory and it is, therefore, natural that many cases of illness, particularly serious illness, should be brought to the city for treatment. In making up the mortality figures every effort has been made to exclude all deaths of persons who certainly were nonresident. This is correction for residence and source of infection in only one direction, but it was the opinion of health officers and physicians that few, if any, residents contracting typhoid fever went elsewhere for treatment. Because of the low urban typhoid incidence it is also improbable that any considerable number of nonresident persons could have been infected while visiting within these cities. Because of this correction for residence, the figures used for the present study will not agree with rates reported from official sources.

Typhoid fever morbidity reporting is required in each city studied; but the actual records available were for the most part incomplete except in Wheeling, where the reporting is excellent. Besides making use of all morbidity information available from both city and State official agencies for the years 1927 and 1928, personal calls were made on the physicians in each city, inquiry was made in the families in which typhoid fever had occurred as to their knowledge of other cases, and, in addition, other persons (such as the filter-plant operators, directors of independent nursing agencies, hospital superintendents, directors of diagnostic laboratories, milk dealers, and sanitary inspectors) were questioned as to their knowledge of illness which might have been typhoid fever. Leads thus obtained were personally investigated. For these reasons the morbidity figures reported in this study are considerably more nearly complete for some of the cities than those reported through the usual official channels, and it is believed that the records as reported show essentially all the cases actually occurring for these two years. Nonresident cases were excluded whenever the information seemed authentic.

QUALITY OF THE WATER

Raw Ohio River water.—Evidence as to the grossly polluted character of the raw Ohio River water scarcely need be presented, since this stream serves as the final source of disposal for the sewage from each sewered community on the Ohio River watershed and also for an enormous quantity of industrial waste discharged by a variety of

industries. Surg. W. H. Frost and his associates [4] of the Public Health Service discuss at some length the polluted character of the river water and they also give some indication of the very large volume of domestic wastes discharged into the river and its tributaries in 1914. By 1927 this volume had greatly increased, both because of the actual population increases and because of the extension of the sewerage systems within each city. So far as is known, essentially all of these systems discharge untreated sewage into the Ohio River or its tributaries.

Besides this knowledge of the number of people contributing their excreta into the Ohio River water, bacteriological records are available which give the *B. coli* indices of the raw river water at the various municipal intakes. The following figures showing the yearly mean *B. coli* index of the untreated Ohio River water, as indicated from the examination of water samples collected at frequent intervals during the year, give a more definite indication of the degree of pollution present.

B. coli per 100 c. c. in Ohio River water at intakes of certain cities (Indices expressed as the annual means)

Year	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth
1914 [1]	9,500	2,230	3,950			2,750
1924	6,450	6,690		22,400	16,700	4,270
1925	11,600	1,630		10,500	16,300	4,900
1926	24,900	6,230		24,900	27,700	5,050
1927	15,500	2,710	1,460	28,100	20,900	5,310
1928	13,300	10,000	7,500	19,400	18,500	6,160

[1] Indices for this year represent the means obtained in the 1914 studies (Public Health Bulletin 143, Table 84) and do not include each month of the year. The sampling points used are near but not identical with those for the other years included in this table. There was no sampling point opposite Ironton in 1914 and Ashland then used water from the Big Sandy River.

The data give in numerical terms some indication of the extent of pollution present in the water opposite each city. The amount of sewage pollution present in the water at each intake is determined by a combination of factors such as the proximity and size of the urban populations living up river, the volume of the stream, its rate of flow, and seasonal influences. Thus East Liverpool is only 44 miles below the city of Pittsburgh with its enormous output of sewage, but the bacterial pollution at East Liverpool is far less than would be anticipated, due to the bactericidal action of the acid wastes entering the river and to the long period of detention usually intervening. By the time the river water reaches Wheeling it has traveled 90 miles and has had a relatively small amount of waste added since leaving Pittsburgh, so that the pollution here is usually less than at East Liverpool and Steubenville. The Ashland intake, 320 miles below

[4] Frost, W. H., et al.: A study of the pollution and natural purification of the Ohio River. Public Health Bulletin No. 142.

Pittsburgh, is only six miles down stream from Huntington, W. Va., a city of approximately 75,000 people. Ironton is only 7 miles below Ashland. While the volume of domestic sewage contributed to the river by Huntington is much less than the Pittsburgh contribution, the distance from Huntington to Ashland and Ironton is too short to permit of any appreciable natural purification, and so the *B. coli* indices of the river water at the Ashland and Ironton intakes are consistently higher than at any other intake on the entire river. The influence of natural purification has made itself felt by the time the water reaches the Portsmouth intake, which is 353 miles below Pittsburgh and 26 miles below Ironton.

It is possible that the *B. coli* index does not have the same sanitary significance at each intake and especially that there may be a seasonal or year-to-year variation in its significance. The destructive action of the forces at play in the natural purification of streams may not be as effective against the colon bacillus as against the typhoid bacillus. Freshness of sewage is an important factor, since the typhoid bacillus probably does not multiply in such artificial environments. The amount and character of the industrial wastes contained in the water may have a more lethal effect on the typhoid bacillus than on the more resistant *B. coli* group. The conditions at East Liverpool lead one to suspect that the highly acid coal-mine and steel-mill wastes which have been added to the river in the Pittsburgh sector may be particularly destructive to the typhoid bacillus. Then again the very considerable decline in typhoid prevalence throughout the Ohio River valley, as elsewhere, has resulted in a proportional decrease in the number of typhoid organisms actually added to the river water though increased susceptibility due to decreased exposure may more or less completely counterbalance any falling off in the number of typhoid bacilli present.

It is interesting to speculate on the relative significance of the *B. coli* indices for the six raw water supplies. The assumption is that raw water of such quality would be highly dangerous if used for drinking purposes. Data which would directly answer the question for the period of the present study are not available, since no urban community has used untreated Ohio River water for drinking purposes since 1925. We can, however, compare the quality of the drinking water and the typhoid incidence before and after the installation of the present modern purification system in each city. The final stage of this installation took place as recently as 1925 in the city of Wheeling. In every city, improvement in the water supply has been followed by an immediate and notable decline in the prevalence of typhoid fever. The only deduction possible from the history of these cities while using raw river water is that the consumption of raw Ohio River water by the inhabitants for the years

1927 and 1928 would have resulted in a very high typhoid fever incidence.

Quality of the adequately treated waters.—In the Appendix of this paper brief histories of the six municipal water supplies are given. Portsmouth, in 1915, was the first city to treat the public water supply in a manner now considered adequate. Wheeling, the last of the six cities to adopt adequate water-purification measures, began the use of filtered water in February, 1925. Thus, by the time of the present study, 1927 and 1928, each plant undoubtedly had gone through its shaking-down period and was operating smoothly.

TABLE 1.—*A summary of the B. coli content of the treated public water supply effluents in the six designated Ohio River cities for the years 1926, 1927, and 1928* [1]

City	Year	Number of sampling days	Number of sampling days on which the total number of B. coli per 100 c. c. was—							Number of sampling days B. coli index exceeded 1 per 100 c. c.	Typhoid fever rates per 100,000	
			2	4	6	8	10	100	1,000		Mortality	Morbidity
East Liverpool	1926	349	38	37	22	13	12	----	----	122	4.4	4.4
	1927	328	28	16	12	7	6	1	----	70	0.0	0.0
	1928	366	29	14	5	5	3	----	----	66	0.0	17.1
Steubenville	1926	295	37	7	5	2	1	----	----	52	0.0	----
	1927	292	4	1	0	1	----	----	----	6	6.0	24.1
	1928	305	5	4	2	2	----	----	----	13	2.9	14.8
Wheeling	1926	365	32	----	----	----	----	----	1	33	1.7	22.1
	1927	365	17	----	----	----	----	----	----	17	0.0	11.0
	1928	366	11	10	----	----	----	----	----	21	0.0	6.7
Ashland	1926	365	1	----	----	----	----	----	----	1	7.8	28.7
	1927	365	0	----	----	----	----	----	----	0	3.8	75.2
	1928	366	0	----	----	----	----	----	----	0	0.0	88.2
Ironton	1926	364	8	----	----	----	----	----	----	8	6.4	75.0
	1927	365	7	----	----	----	----	----	----	7	0.0	40.7
	1928	366	21	----	----	----	----	----	----	21	0.0	33.7
Portsmouth	1926	347	6	----	----	----	----	----	----	6	5.1	38.1
	1927	362	7	----	----	----	----	----	----	7	0.0	24.7
	1928	365	8	----	----	----	----	----	----	8	12.2	62.9

[1] See Appendix, Table A, for more detailed data.

A record of the almost daily bacteriological analyses of each filter plant effluent water for the years 1926, 1927, and 1928 is given in Appendix, Table A, in the form of monthly summaries. These figures are further summarized in Table 1. It will be seen from these tables that at no time during the entire three years did the recorded *B. coli* index in Portsmouth, Ironton, or Ashland exceed 2 per 100 c. c., that is, at no time did more than one of the five 10-c.c. fermentation tubes planted for each analysis show *B. coli* fermentation. Wheeling had one analysis in June 1926 which showed *B. coli* present in 0.01 c. c. of effluent water. A sudden and unusual turbidity change in the river water occurred during the temporary absence of the plant operator, when some improperly treated water had passed through the plant into the clear well before the operator could be called and the necessary operative changes could be made, but the

lapse is known to have been only of a few hours' duration. More frequent lapses occurred in both Steubenville and East Liverpool, particularly in the latter, but with one exception the index did not exceed 10 per 100 c. c. The altogether too frequent failures to maintain a high standard at the East Liverpool plant were due to a misinterpretation of the methods of calculating the confirmed *B. coli* index under the Treasury Department standard. For some reason the *B. coli* confirmation was changed from the 48-hour to the 24-hour gas tube, resulting in a *B. coli* index below that which would have occurred had the standard methods been followed. Fortunately the 48-hour confirmation had been in use for a sufficient period of time (over two years) to give a fair indication of the percentage of 48-hour gas confirmations obtainable during each month of the year. These percentages have been applied to the reported 48-hour gas formation index where necessary in East Liverpool for the years 1926, 1927, and 1928, so that the *B. coli* data contained in Table 1, and Appendix Table A, are based on the actually confirmed results, or on calculations made in the manner just described. Any error introduced by this method of estimating the 48-hour confirmed *B. coli* is not sufficiently great materially to affect the interpretations.

Quality of the inadequately treated waters.—Except for this lapse in East Liverpool the drinking waters provided the six cities during 1927 and 1928 were of excellent quality. It becomes necessary to go further back into the records in order to find periods when the water supplies were inadequately treated, but we are then confronted with the fact that bacteriological records are either entirely lacking or are very meager.

Ashland, prior to the inauguration of the present plant in 1922, had for a number of years used water from a plant situated on the Big Sandy River at Catlettsburg, Ky. A limited number of *B. coli* determinations were made on the raw water during the five months beginning with June 1914, for which period the mean index was 1,260 per 100 c. c. A total of 14 analyses of the treated water were made during the same period, and these showed the *B. coli* indices varying from less than 2 per 100 to 1,000 per 100 c. c., with a mean of 90 for the period.

The East Liverpool plant was operated from June 1916 to Septem- 1922 with untrained personnel, directed by a part-time, though competent, supervisor. The records of the few bacteriological analyses made have been lost, but it is known that the quality of the effluent water was not uniformly good.

Wheeling affords the most satisfactory record, even though it is very incomplete, of a gradual progression from the use of raw river water to a supply which meets modern sanitary requirements. All of the available bacteriological analyses made since 1910 have been

summarized in Table 2, where they are set off according to the character of the water provided. The data are deficient for the years 1918 to 1924, both inclusive, in that 48-hour gas formation was reported as *B. coli* without confirmation, and because the range dilutions used in determining gas formation was not sufficiently great always to insure a negative result in the highest dilution. Therefore, the maximum observed indices and the mean indices reported in Table 2 for these years (1918–1925) are generally too low. An analysis of the reported bacteriological determinations for the period 1918–1924 indicates that, even with the haphazard method of chlorination employed and the absence of regular laboratory control, an average index of 20–50 per 100 c. c. was obtained, which is an improvement on the raw river water previously supplied.

TABLE 2.—*The B. coli indices of the public water supply of Wheeling, W. Va. for certain years; also a record of the reported typhoid fever cases and deaths (corrected for residence) occurring during these years within the city boundaries as existing in 1914*

Year	Chronological number of the sampling months	Actual number of sampling days	B. coli index per 100 c. c.[1]			Typhoid fever	
			Per cent of sampling days index exceeded 1 per 100 c. c.	Mean of actual sampling days	Maximum observed index	Reported cases	Reported deaths
RAW OHIO RIVER WATER							
1914	4, 5, 6, 7, 8, 9, and 10	(?)	59	1,996.5	10,000	69	20
1915						63	15
1916						79	9
1917						153	12
YEAR OF CHANGE TO CHLORINATED SUPPLY							
1918	5, 6, 7, and 8	8	100	109.5	1,000	120	13
CHLORINATED OHIO RIVER WATER							
1919	1, 3, and 4	5	100	49.1	100	26	3
1920	All but 5 and 9	18	78	27.5	100	37	7
1921	1, 2, 3, and 4	7	86	47.1	100	19	8
1922	All months	108	55	24.8	100	15	4
1923	1, 2, 4, 7, 8, 9, and 10	21	43	8.6	100	17	3
1924	All but 5, 8, and 9	30	87	20.3	100	25	4
YEAR OF CHANGE TO FILTERED SUPPLY							
1925	All but 1 and 2	306	1	0.03	10	21	1
RAPID SAND FILTRATION WITH CHLORINATION OF OHIO RIVER WATER							
1926	All months	365	90	3.4	[3] 1,000	9	0
1927	do	365	47	.09	2	5	0
1928	do	366	57	.17	4	2	0

[1] The *B. coli* indices for the years 1918–1924, inclusive, are based on the 48-hour presumptive test. An average of 80 per cent of the raw water 48-hour gas formers at Wheeling will confirm as *B. coli*. The range of dilutions used for 48-hour gas determination for the years 1918–1924 was not sufficiently great always to insure a negative result in the highest dilution. Therefore, the maximum and mean indices recorded in this table for this period may in some instances be too low.

[2] 3 days each week.

[3] An operative breakdown occurred of a few hours' duration. The actual quality of the water coming from the taps in the city is not known. The mean index without this one high count is 0.17 per 100 c. c., and the maximum observed index 2 per 100 c. c.

TYPHOID FEVER HISTORIES

The history of typhoid fever prevalence in the six river cities studied, as revealed from a search of all the death records in each city, is given in Table 3. Every effort has been made to include in this tabulation only authentic typhoid fever deaths of actual residents. The mortality rates have been computed from popuation estimates based on the 1910, 1920, and 1930 Federal Census returns. These estimates are recorded in the Appendix Table B.

TABLE 3.—*The annual number of deaths (corrected for residence) in each Ohio River city studied for the period 1910–1928, inclusive, and the yearly death rates per 100,000 population.*

Year	Deaths from typhoid fever						Death rate per 100,000					
	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth
1910	12	8	11	-------	3	15	58.9	35.5	26.4	-------	22.8	63.4
1911	13	7	9	6	14	18	63.4	30.3	21.6	63.5	105.8	73.0
1912	8	16	17	9	14	18	38.9	67.4	40.9	89.5	105.0	70.2
1913	14	10	16	7	9	30	67.6	41.0	38.6	65.5	67.0	113.0
1914	19	17	20	2	10	[3] 33	91.4	63.0	48.1	17.7	74.0	[1] 119.3
1915	11	[1] 11	15	2	4	7	52.5	[3] 42.8	36.2	16.8	29.4	24.5
1916	9	6	9	6	7	4	42.7	22.8	21.6	47.7	51.1	13.5
1917	6	[2] 13	12	6	13	5	28.4	[2] 48.2	29.0	45.6	94.4	16.4
1918	11	1	13	8	14	6	51.7	3.6	31.4	58.0	101.0	19.1
1919	5	2	3	4	3	8	23.4	7.1	7.2	27.8	21.5	24.6
1920	6	3	9	2	10	5	27.9	10.4	16.0	13.3	71.5	14.9
1921	6	1	[2] 16	3	[1] 0	0	27.9	3.4	[2] 28.2	14.2	[1] 0.0	0.0
1922	[1] 3	0	5	[1] 1	2	3	[1] 13.8	0.0	8.7	[1] 4.5	13.7	8.5
1923	0	0	2	0	1	3	0.0	0.0	3.4	0.0	0.7	8.3
1924	1	1	[2] 11	1	1	1	4.5	3.2	[2] 18.8	4.2	6.6	2.7
1925	0	2	[1] 3	[2] 10	1	1	0.0	6.2	[1] 5.1	[2] 40.3	6.5	2.6
1926	1	0	2	2	1	2	4.4	0.0	3.3	7.8	6.4	5.1
1927	0	2	0	1	0	0	0.0	6.0	0.0	3.8	0.0	0.0
1928	0	1	0	0	0	5	0.0	2.9	0.0	0.0	0.0	12.2

[1] The new water purification plant with full time operative and laboratory control began operation in this year.
[2] Localized epidemics due to pollution of local community wells.
[3] A sharp increase occurred in the typhoid incidence throughout this section of Kentucky in this year. No apparent connection with the public water supply in Ashland was evident.

In order to demonstrate more clearly the relation which the drinking water had to the typhoid fever prevalence a summary table (Table 4) is presented, which shows for each city the mean mortality rate during the 3-year period immediately preceding and the three years immediately subsequent to any significant change in the quality of the water supply, omitting in each instance the year in which the change became effective. Notations appearing as footnotes indicate the character of the changes taking place.

It should be emphasized at this time that these improvements in the quality of the water supply became effective within the space of a very short time. Other sanitary improvements, such as the extension of the sewerage systems with the accompanying elimination of the privy, elimination of fly hazards, greater protection of the city's milk supply etc., were taking place concurrently. However, such changes came about very slowly and in a piece-meal fashion,

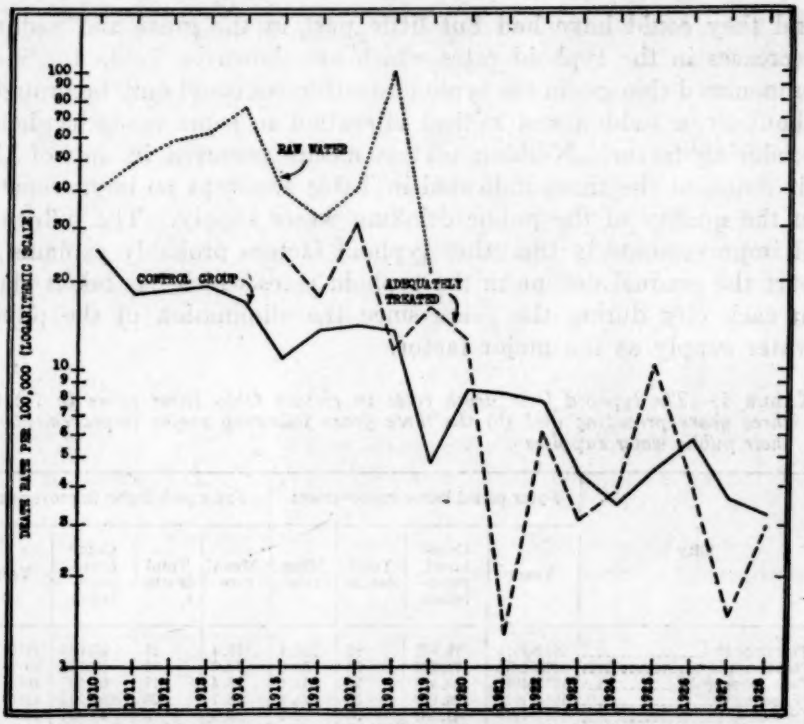
and they could have had but little part in the great and sudden decreases in the typhoid rates which are shown in Table 4. Such pronounced changes in the typhoid death rates could only be brought about by a sudden and radical alteration in some major typhoid-producing factor. Nothing of this nature occurred in any of the six cities, at the times indicated in Table 4, except an improvement in the quality of the public drinking water supply. The influence of improvements in the other typhoid factors probably explains in part the gradual decline in the typhoid rates which has taken place in each city during the years since the elimination of the public water supply as the major factor.

TABLE 4.—*The typhoid fever death rates in certain Ohio River cities in (a) the three years preceding and (b) the three years following major improvements in their public water supplies*

City	3-year period before improvement				3-year period after improvement			
	Years	Combined population	Total deaths	Mean rate	Mean rate	Total deaths	Combined population	Years
Portsmouth [1]	1912-1914	79,872	81	101.4	10.4	15	91,665	1916-1918
Steubenville [1]	1913-1915	75,201	38	50.6	19.3	[2] 16	82,833	1917-1919
East Liverpool [3]	1915-1917	63,174	26	41.1	26.4	17	64,537	1919-1921
Wheeling [4]	1915-1917	124,680	36	28.9	18.1	[5] 28	154,512	1919-1921
Ironton [6]	1917-1919	41,583	30	72.2	6.9	3	43,691	1921-1923
Ashland [7]	1917-1919	41,430	18	43.5	15.3	[8] 11	71,679	1923-1925
East Liverpool [9]	1919-1921	64,537	17	26.4	1.5	1	66,570	1923-1925
Wheeling [10]	1922-1924	173,808	[11] 18	10.4	1.1	2	180,720	1926-1928

[1] Changed from raw river water to filtered and chlorinated supply.
[2] Includes localized epidemic not related to public water supply. With epidemic year removed, rate is 5.4.
[3] Changed from raw river water to inadequately controlled filtered and chlorinated supply.
[4] Changed from raw river water to chlorinated supply.
[5] Includes localized epidemic not related to public water supply. With epidemic year removed, rate is 12.3.
[6] Changed from raw river water to filtered and chlorinated supply.
[7] Changed from inadequately filtered Big Sandy river water to filtered and chlorinated Ohio River water.
[8] Includes localized epidemic not related to public water supply. With epidemic year removed, rate is 2.1.
[9] Changed from inadequately controlled filtered and chlorinated supply to one adequately controlled.
[10] Changed from chlorinated supply to filtered and chlorinated supply.
[11] Includes localized epidemic not related to public water supply. With epidemic year removed, rate is 6.1.

The data given in Table 3 have been rearranged in Table 5 in order to show the combined typhoid histories of these six cities since 1910 on the basis of the quality of the public water supplies; (*a*) all cities using raw river water; (*b*) all cities using inadequately treated river water; (*c*) those using effectively purified supplies; and (*d*) a control group consisting of eight cities, situated on the Ohio River watershed, of approximately the same size as those in the study group and which had, at the time of the 1914 sanitary survey, a public water supply rating 90 per cent or better. The rates recorded in Table 5 have been plotted in the accompanying graph.



Curves showing the death rates in the six Ohio River cities grouped according to the quality of the public drinking water; also the curve for a control group of cities. (A local epidemic appeared in Steubenville in 1917 and one in Ashland in 1925 which bore no demonstrable connection with the public water supply. See Table 3 and footnotes 2 and 3 to that table.)

TABLE 5.—*The typhoid fever death rates in certain Ohio River cities when their public water supply was (a) raw Ohio River water, (b) inadequately treated river water, and (c) adequately treated river water, and the rates in a control group of cities on the Ohio River watershed*

Year	Population using raw Ohio River water			Population using inadequately treated Ohio River water			Population using adequately treated Ohio River water			Control group comprising 8 cities [1]		
	Population	Typhoid fever		Population	Typhoid fever		Population	Typhoid fever		Population	Typhoid fever	
		Deaths	Rate		Deaths	Rate		Deaths	Rate		Deaths	Rate
1910	121,424	49	40.4							180,832	45	24.9
1911	123,223	61	49.5	9,442	6	63.5				188,536	34	18.1
1912	125,022	73	58.4	10,066	9	89.5				196,244	37	18.9
1913	126,816	79	62.3	10,690	7	65.5				203,944	39	19.2
1914	128,620	99	77.0	11,314	2	17.7				211,644	36	17.0
1915	101,827	41	40.3	11,938	2	16.8	28,592	7	24.5	219,352	25	11.4
1916	76,305	25	32.8	12,562	6	47.7	55,913	10	17.9	227,060	31	13.7
1917	76,487	31	40.5	13,186	6	45.5	57,530	[2] 18	31.5	234,764	33	14.1
1918	13,861	14	101.0	76,617	32	41.8	59,148	7	11.8	242,472	33	13.6
1919	13,948	3	21.5	77,336	12	15.5	60,765	10	16.4	250,176	12	4.8
1920				77,698	15	19.3	62,385	8	12.8	258,033	22	8.5
1921				78,449	22	28.0	78,292	1	1.3	263,912	22	8.3
1922				57,360	5	8.7	80,166	5	6.2	269,791	21	7.8
1923				57,936	2	3.4	127,044	4	3.1	275,670	12	4.4
1924				58,512	11	18.8	129,991	5	3.9	281,549	10	3.5
1925							132,938	[3] 14	10.5	287,428	13	4.5
1926							195,549	8	4.1	293,307	17	5.8
1927							199,072	3	1.5	299,186	11	3.7
1928							202,595	6	2.9	305,065	10	3.3

[1] The control cities selected are of approximately the same size, they are all located on the Ohio River watershed, and at the time of the 1914 sanitary survey each city had a public water supply which rated 90 per cent or more. The group included Canton, Chillicothe, Hamilton, Lancaster, Mansfield, Marion Massillon, and Middletown.

[2] See footnote 2 accompanying Table 3. With Steubenville omitted, rate becomes 16.4.

[3] See footnote 3 accompanying Table 3. With Ashland omitted, rate becomes 3.7.

The figures show a consistently high rate for cities using the raw river water and without any apparent tendency to decline. With the introduction of an inadequately treated supply the rates declined somewhat over those in group (*a*) but still remained very high as compared to the control group. The inauguration of an effectively treated supply caused a sharp decline in the typhoid rates so that these cities now compared very favorably with the control group which had been using presumably safe water at least since 1914. The death rate curve for group (*c*) cities falls even below that for the control cities. The conclusion is warranted that the installation of effective water purification systems in the six cities under consideration was sufficient to reduce the typhoid rates to the level existing in cities with approved water supplies. The remaining typhoid incidence in either group is no greater than could reasonably be accounted for as due to factors other than a contaminated water supply.

A more specific and striking illustration of the weight of the water supply as a typhoid factor is obtained by studying the record in Wheeling as given in Table 2. Up until October, 1918, the city-water mains delivered raw Ohio River water with a mean *B. coli* index of approximately 2,000 per 100 c. c., though only about 50 per cent of the population used it for drinking purposes. Even with this limited use the mean typhoid death rate for the six years preceding was 35.7 per 100,000. Then followed a period of slightly more than six years of indifferent chlorination without systematic laboratory control while the city fathers debated the type of water purification which Wheeling should have. Such treatment did reduce the *B. coli* index to an average of 30 per 100 and at the same time the typhoid death rate for the six years averaged 11.5 for that part of the population living within the 1914 city boundaries. (It has been necessary to retain the old city boundaries throughout Table 2 in order to have directly comparable population groups from year to year.) In February, 1925, the present purification plant became effective, and from that time until the end of 1928, when the present study ended, only one resident death from typhoid fever occurred within the 1914 city boundaries. Of the 15 cases reported for the years of effective water purification (1926, 1927, and 1928) within the 1914 city limits, 11, or 73 per cent, were reported within the 6-month period beginning with June. For the three years immediately preceding the year of beginning effective purification (1922, 1923, and 1924), 57 cases were reported, of which only 30, or 53 per cent, fell within the corresponding 6-month summer-fall period.

Seasonal distribution.—The monthly distribution of deaths from typhoid fever is shown in Table 6 and of reported cases in Table 7.

The combined figures for 3-year periods were used because of the relatively small number of deaths occurring, especially following water purification. The reported deaths and cases in Tables 6 and 7, respectively, have been set back to the actual month of infection where such information was available. In the absence of this information deaths were set back 40 days from the actual date of death and cases were set back 25 days from the date of reporting. These figures represent the average days as determined from a large group of cases in which complete information was available. This method was adopted so as to have uniform records for each city, irregularities in reporting cases making some method of adjustment necessary. The seasonal distribution of both cases and deaths for the 3-year period immediately prior to purification of the water supply corresponds to the accepted distribution for communities which use a heavily contaminated water throughout the year, the rate being uniformly high in each month, with a majority of the deaths occurring in the six months beginning with December (actually 54 per cent as compared to 46 per cent for the summer-fall season). This is similar to the curve reported by Freeman[5] for another group of Ohio River cities which in 1914 had a public water supply with a "safety rating" of less than 50. This uniformly high incidence before filtration is in sharp contrast to the low incidence and the summer-month grouping for the 3-year period ending with 1928, during which time the inhabitants used a good water supply. It will be seen from the data in the two tables that only 16.7 per cent of the deaths and 18.7 per cent of the reported cases occurred within the 6-month period beginning with December. This distribution curve agrees in character with the one presented by Freeman for cities having a public-drinking water with a safety rating of 90 or more.

[5] Freeman, A. W.: Typhoid fever and municipal administration. Public Health Reports, vol. 32, No. 18, May 4, 1917.

TABLE 6.—*The distribution of deaths from typhoid fever by months in the six designated cities during a 3-year period immediately prior to the installation of the present public-water supply, and for a similar period ending with 1928 (deaths set back to estimated month of infection)*

Month	3-year period immediately prior to filtration								3-year period of 1926–1928, inclusive							
	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth	Total	Percentage distribution	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth	Total	Percentage distribution
January	5	8	4	1	1	7	26	11.1	0	0	1	0	0	0	1	5.5
February	1	4	2	0	6	7	20	8.5	0	0	0	0	0	0	0	0.0
March	3	4	2	0	2	9	20	8.5	0	0	0	0	0	0	0	0.0
April	0	3	2	0	3	16	24	10.2	0	0	1	0	0	0	1	5.5
May	2	0	3	0	2	8	15	6.4	0	0	0	0	0	0	0	0.0
June	3	9	2	1	4	3	22	9.4	0	0	0	0	0	1	1	5.5
July	2	5	3	6	3	5	24	10.2	0	0	0	0	0	1	1	5.5
August	0	1	3	3	2	5	14	5.9	0	1	0	2	0	2	5	27.9
September	3	1	3	1	4	4	16	6.8	0	2	0	1	0	0	3	16.8
October	0	0	4	2	3	2	11	4.7	0	0	0	0	1	2	3	16.8
November	3	2	4	3	2	7	21	8.9	0	0	0	0	0	2	2	11.0
December	4	1	4	1	2	10	22	9.4	1	0	0	0	0	0	1	5.5
Total	26	38	36	18	34	83	235	100.0	1	3	2	3	1	8	18	100.0

TABLE 7.—*The distribution of reported cases of typhoid fever by months in Ironton and Wheeling during a 3-year period immediately before the installation of the present public-water supply and a similar period ending with 1928 (cases set back to the estimated month of infection)*

Month	Before				After			
	Wheeling	Ironton	Total cases	Percentage distribution	Percentage distribution	Total cases	Wheeling	Ironton
January	13	16	29	5.9	11.1	6	6	0
February	8	16	24	4.9	3.7	2	2	0
March	5	22	27	5.5	0.0	0	0	0
April	6	15	21	4.3	1.9	1	1	0
May	7	19	26	5.3	5.5	3	0	3
June	67	8	75	15.3	5.5	3	3	0
July	51	12	63	12.7	18.5	10	6	4
August	31	17	48	9.8	24.1	13	6	7
September	20	12	32	6.5	16.7	9	4	5
October	36	18	54	11.0	11.1	6	2	4
November	27	21	48	9.8	0.0	0	0	0
December	20	24	44	9.0	1.9	1	1	0
Total	291	200	491	100.0	100.0	54	31	23

NOTE: Records are incomplete for the other four cities.

It is not permissible to infer, either from this marked decrease in the actual prevalence of typhoid or from the sharp reversal in the seasonal distribution following use of the new water supply, that no case of typhoid fever can originate from this new supply. However, from the low incidence and the character of the seasonal curve it is apparent that the possible number of persons thus infected has at least been very greatly reduced and that those avenues of transmission commonly at work in the summer and fall months now greatly predominate the picture.

Age.—Table 8 shows the age distribution of the reported cases before and after filtration of the water supply. The age curve following filtration has not changed materially from that existing when the general public drank raw river water. The age group, 0–19 years, provides 59.9 per cent of the cases before filtration and 59.2 per cent in the three years ending with 1928. This is in contrast with 47 per cent among all cases reported in Michigan, Minnesota, and Pennsylvania for the year 1913.[6] The higher figures for the younger group in the Ohio River cities are probably due to two entirely different factors. Before filtration all ages were almost constantly exposed with the younger ages constituting the only really susceptible group since the older ones had built up an immunity. Following filtration the percentage of cases occurring among the 0–19 age group remains high because persons in this portion of the population, besides being susceptible, are exposed more frequently to the predominating sources of infection.

TABLE 8.—*Age distribution of reported cases of typhoid fever immediately preceding and following the installation of effective water purification plants*

Age group	3-year period preceding installation				3-year period after installation			
	Wheeling	Ironton	Total cases	Percentage distribution	Percentage distribution	Total cases	Wheeling	Ironton
0 to 4	10	22	32	7.2	1.8	1	0	1
5 to 9	57	42	99	22.4	24.2	13	7	6
10 to 14	51	26	77	17.5	25.9	14	7	7
15 to 19	30	26	56	12.7	7.4	4	3	1
20 to 29	64	40	104	23.6	22.2	12	5	7
30 to 39	31	18	49	11.1	9.3	5	4	1
40 to 49	5	8	13	3.0	5.6	3	3	0
50 to 59	3	3	6	1.4	1.8	1	1	0
60 to 69	1	4	5	1.1	1.8	1	1	0
Total	252	189	441	100.0	100.0	54	31	23

NOTE.—Records are incomplete for the other four cities.

Sex.—The sex distribution is given in Table 9. There has been a slight increase since filtration in the percentage of infected males which could be explained on the basis of greater exposure among boys to present sources of infection.

Drinking water and typhoid fever prevalence.—An analysis of the bacteriological and typhoid fever data presented in Table 1 and Appendix Table A fails to show any correlation between the prevalence of typhoid fever and the bacterial quality of the public water supply. No significant lapses occurred in the quality of the Ashland, Ironton, or Portsmouth supplies, whereas the typhoid rates show considerable variation. A very brief but serious lapse did occur in Wheeling in June, 1926. Both the reported cases and deaths were

[6] Public Health Reports, vol. 30, No. 8, Feb. 19, 1915, p. 534.

greater in 1926 than in either 1927 or 1928, but neither the total numbers nor the most probable dates of actual infection suggests sufficient reasons for identifying them as related to the lapse in water quality. In fact a study of each individual case history suggests other more probable sources of infection. The poorest quality of drinking water is shown in East Liverpool, where slight but frequent lapses occurred each year; yet this city has been freer from typhoid fever than any of the other five. This city's morbidity records for 1926 are incomplete. A careful search was made for cases in both 1927 and 1928, and it is felt that the four cases reported for these two years represent a complete record of typhoid fever among the 23,000 inhabitants for these two years—a very low incidence.

TABLE 9.—*The sex distribution of persons reported with typhoid fever before and after the installation of the present public water supply*

City	Before filtration		After filtration	
	Male	Female	Male	Female
Wheeling	143	120	15	16
Ironton	84	105	14	9
Total	227	225	29	25
Percentage distribution	50.2	49.8	53.7	46.3

Certain distinct epidemics have occurred in two of the cities since they began the use of drinking water from the present purification plants. In 1917 Steubenville had a total of 13 deaths (Table 3) as compared with 6 in 1916 and only 1 in 1918. The history of the filter plant for that year records no operative lapse. Nine of the 13 deaths occurred in the five months beginning with June and were grouped in one section of the city surrounding a hillside spring. The reports of the attending physicians indicate that all nine persons had either drunk from this spring or were direct family contacts with infections in persons who had done so. Analysis of the spring water showed high *B. coli* pollution. Ten deaths occurred in Ashland in 1925 in contrast with one in 1924 and two in 1926. The quality of the water supply showed no lapse for this year. The distribution of the deaths in the city does not suggest a connection with the public water supply, inasmuch as many were in homes in sections of the city which are essentially rural and use water from other sources. While the cause for this increased prevalence remains unexplained, there is nothing about it which would incriminate the public water supply.

EPIDEMIOLOGY OF THE REPORTED 1927 AND 1928 CASES

By 1927 the prevalence of typhoid fever in the six cities studied had reached such a low point that a statistical analysis of the mortality and morbidity reports as given to the health departments fails to give

definite indication as to the possible source of infection. More specific information bearing on every phase of each individual case is needed before this residual typhoid fever can be explained. Even then it may not be possible to say with certainty that such and such is the mode of infection. The detailed case epidemiological histories should, however, be sufficient to judge the possible responsibility of any factor which is as common to all the inhabitants as the public water supply. Such case histories were obtained by personal interviews with the patient, the family, or both, in each city for the years 1927 and 1928. Contact could not be made with every case, but sufficient interviews were obtained to give very good samples.

The total number of cases obtained from the health department records and by personal search in each city was 78 in 1927, and 99 in 1928. Tables 10 and 11 have been arranged so as to show certain facts as to residence, diagnosis, numbers investigated, and history of direct contracts.

TABLE 10.—*Actual number of reported cases of typhoid fever for the year 1927 in each of the six Ohio River cities studied, and certain facts regarding each case*

Information regarding cases	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth	Total
Total cases reported in each city in 1927	2	10	23	24	6	13	78
Nonresident cases included in reports	1	2	14	1	0	3	21
Actual resident cases reported for 1927	1	8	9	23	6	10	57
Cases not considered as typhoid fever	1	0	1	1	0	1	4
Resident cases accepted as typhoid fever	0	8	8	22	6	9	53
Resident cases not investigated	0	2	0	10	1	1	14
Resident cases investigated	0	6	8	12	5	8	39
Resident cases returning ill to city		0	1	0	0	1	2
Considered actual resident cases		6	7	12	5	7	37
Resident cases having direct contact with a known case		1	1	6	0	2	10
Resident cases remaining and investigated		5	6	6	5	5	27

TABLE 11.—*Showing the actual number of reported cases of typhoid fever for the year 1928 in each of the six Ohio River cities studied, and certain facts regarding each case*

Information regarding cases	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth	Total
Total cases reported in each city in 1928	4	6	17	38	6	28	99
Nonresident cases included in reports	0	1	10	10	1	2	24
Actual resident cases reported for 1928	4	5	7	28	5	26	75
Cases not considered as typhoid fever	0	0	2	1	0	0	3
Resident cases accepted as typhoid fever	4	5	5	27	5	26	72
Resident cases not investigated	0	0	0	0	0	4	4
Resident cases investigated	4	5	5	27	5	22	68
Resident cases returning ill to city	1	0	1	2	0	5	9
Considered actual resident cases	3	5	4	25	5	17	59
Resident cases having direct contact with a known case	1	0	0	8	1	10	20
Resident cases remaining and investigated	2	5	4	17	4	7	39

For the year 1927 (Table 10) 21 of the reported cases were nonresidents who were brought to the city for care and treatment. Four others gave atypical symptoms, and so were not considered as typhoid fever, and 14 cases, though not personally investigated, were believed to have been genuine typhoid cases. Similarly in 1928 (Table 11) 24 were proved nonresident cases, 3 had atypical symptoms and negative Widal reactions, and 4 were not investigated. There remained 39, or 74.5 per cent of all the actual resident cases reported in 1927, and 68, or 94.5 per cent reported in 1928, which were personally investigated by the writer. It was found that four of the 1927 cases and nine in 1928 occurred in proved residents who had been absent from their home city for more than the possible incubation period and returned to their homes only after the onset of symptoms. These cases were, therefore, not considered further. The symptomatology and clinical picture in each of the remaining cases conformed to those of typhoid fever. Widal or blood culture examinations were made on 16 cases in 1927 and on 41 cases in 1928. Positive findings were obtained in 100 per cent of the 1927 cases and in 97.6 per cent of the 1928 cases.

The record of cases is believed to be approximately complete, since in 1927 there occurred 3 typhoid deaths as against 53 recorded genuine resident cases and in 1928 6 deaths and 72 similar cases.

An analysis of the epidemiological case histories of the 39 cases investigated in 1927 reveals the fact that 10 had had direct and intimate contact with a previous case in their own household, or in that of a relative. Similarly, in 1928, of the 59 cases studied, 20 cases gave such a history of contact. Since the danger of acquiring infection from such exposure, especially in the types of homes wherein these cases actually occurred, was so much greater than from any other known source, it did not seem necessary to study these 30 cases further. There remains a group of 66 cases for the 2-year period which occurred in persons who gave evidence of exposure to a variety of possible sources of infection. The cases were widely scattered in each city and were sporadic in character.

TABLE 12.—*A summary of the epidemiological histories of the persons reported with typhoid fever in the six Ohio River cities who were not eliminated in Tables 10 and 11, and who did not give a history of direct contact*

	1927 (27 resident cases considered)		1928 (39 resident cases considered)		2-year totals (66 resident cases considered)	
	Number	Per cent	Number	Per cent	Number	Per cent
Onset June to November (both inclusive)	25	92.5	32	82.0	57	86.4
Absence from city within 30 days	16	59.2	21	53.9	37	56.0
No public water supply in home	3	11.1	10	25.8	13	19.7
No sanitary sewer connection in home	4	14.8	21	53.8	25	37.9
Economic status of home poor to fair	21	77.8	32	82.0	53	80.3
Sanitary status of home poor to fair	21	77.8	30	77.0	51	77.3
Drinking known polluted water or water of unknown quality or swimming therein	24	88.9	37	95.0	61	92.5

The more significant facts are summarized in Table 12. The figures in this table suggest a picture which was not common to the entire population of the six cities. Fifty-six per cent of the infected persons had been absent from the city within the 30 days just prior to the onset of symptoms; a turnover which was probably much greater than for the population as a whole. The very definite summer-fall grouping observed in Table 7 is slightly more pronounced for the cases remaining in Table 12. From information collected at the time of making a sanitary survey of each city in 1928, it is estimated that less than 5 per cent of the combined 6-city population used water other than the public water supplies in their homes for drinking purposes. Actually 19.7 per cent of the cases reported in Table 12 were without the public water supply. Similarly the homes of approximately 20 per cent of the entire combined population were not connected to the sanitary sewers, as compared with 37.9 per cent of the homes having typhoid cases in 1927 and 1928. No information was available which gave the exact economic and sanitary status of each household in the six cities. However, it is a known fact that the percentage of families in the population as a whole who were in economically "poor to fair" circumstances, or who lived under "poor to fair" sanitary surroundings, fell far below the very high percentage recorded for those households in which cases occurred. This was even more strikingly illustrated from the home visits made to each case. The definite grouping of the cases into sections of the cities where economic and sanitary conditions were low was very evident. The character of the homes and the type of the occupants in a large majority of the homes in which cases occurred were the same in each city. There existed a seeming indifference to economic improvement, and the desire for sanitary or hygienic surroundings in the home seemed never to have been acquired.

With approximately 95 per cent of the combined population in the six cities studied supplied with public drinking water, the opportunity for the average citizen to obtain other water for drinking purposes was greatly limited. Also it is believed that the portion of the population is not very large which will go swimming when the only facilities are a known grossly polluted and muddy river or some less accessible body of water. Actually 92.5 per cent of the cases occurred in persons who either drank known polluted water or water of a suspicious or unknown character, or went swimming, wading, or playing in such waters.

The age distribution of the reported cases as given in Table 8 shows that 62.3 per cent were less than 20 years of age. Of the 66 cases analyzed in Table 12, 75.8 per cent were less than 20 years of age, as compared to 47 per cent reported by three of these six cities in 1913. This fact further strengthens the belief that the chief source or sources

of infection to which the population was exposed in 1927 and 1928 were particularly peculiar to the activities of childhood.

The epidemiological picture which is constructed from the histories of the 66 cases analyzed in Table 12 strongly suggests that the source or sources of these infections were some factors peculiar to travel away from home, to poor sanitary surroundings and indifference to personal cleanliness, to the ingestion of polluted drinking waters from private sources, or to two or more of these factors in combination. The major typhoid factor was also one to which persons under 20 years of age were exposed more frequently than were older persons, though here susceptibility may have been a slight factor. The epidemiological picture gives no evidence that the public water supplies which were used by approximately 95 per cent of the entire population could have been the disseminating factor in any significant number of these cases if, in fact, it could have been the factor in a single case.

SUMMARY AND CONCLUSION

This study of the relation between the residual typhoid fever and the quality of the municipal public water supplies in the six designated Ohio River cities, as indicated by *B. coli* index, may be summarized in the following manner:

1. The Ohio River is the source of the public water supply for each city studied. Originally this was supplied to the public without treatment, but at the time of this report all six supplies are treated by coagulation-sedimentation-filtration and disinfection with chlorine. Prior to the installation of effective treatment the public drinking water had an excessively high *B. coli* index during each month of the year. Following purification, as indicated by the years 1926, 1927, and 1928 (Table 1 and Appendix Table A) the *B. coli* index of the Portsmouth supply was less than 2 per 100 c. c. for 98.1 per cent of the days, Ironton 96.7 per cent, Ashland 99.9 per cent, Wheeling 93.6 per cent, Steubenville 92.1 per cent, and East Liverpool 76.8 per cent. The Portsmouth, Ironton, and Ashland supplies never exceeded an index of 2 per 100 c. c. Wheeling exceeded this index on 1.0 per cent of the days, Steubenville on 2.9 per cent, and East Liverpool on 14.4 per cent.

2. During the period of raw water consumption the typhoid fever incidence in each city was uniformly very high in every month of the year—a seasonal distribution which is typical of endemic water-borne typhoid fever. Following the installation of the present public water supplies the typhoid incidence promptly fell to a low rate comparable with rates prevailing in other cities on the Ohio River watershed which have had, at least since 1914, safe water supplies. At the same time the seasonal distribution changed so as to give a definitely summer and fall disease.

3. A detailed epidemiological study of the cases of typhoid fever reported in these six cities during 1927 and 1928 failed to reveal any evidence, either direct or presumptive, which in any way implicated the public water supply as a vehicle for the transmission of the disease. Ample evidence did accumulate to indicate that other modes of transmission were in all probability the route of contact.

4. Therefore, the conclusion seems justified on the basis of the evidence presented in this study that the quality of the public water supplies for the years 1927 and 1928 in the six Ohio River cities studied was sufficiently good to eliminate the public drinking water as a measurable source of typhoid fever infection.

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Appendix

The history of the public water supplies of the six cities included in the present study, beginning with 1910, is presented in the following abstract form:

East Liverpool.—From 1910 to June, 1918, raw Ohio River water with a brief storage period in an open reservoir. It was estimated in 1914 that this supply was used by 75 per cent of the population. A modern rapid sand filtration plant with chlorination went into operation in June, 1918. This plant was then operated for some time under part-time technical supervision and without adequate laboratory control. It is considered that during this period the sanitary control was inadequate. Since October, 1922, the plant has been operated under full time competent supervision and daily laboratory control. At least 98 per cent of the population used the public supply exclusively in 1928. The remaining 2 per cent used well water of good quality.

Steubenville.—From 1910 to January, 1916, raw river water was pumped directly into the city mains. By January, 1916, a modern rapid sand filtration plant with chlorination had been completed and placed in operation. It has been continuously operated since that time under full time competent supervision with daily laboratory control. Approximately 70 per cent of the population drank raw river water in 1914, whereas in 1928 at least 98 per cent used the

purified public supply. A few wells still remain in use in isolated sections.

Wheeling.—From 1910 to October, 1918, the public supply was raw Ohio River water, pumped directly into the mains. Approximately 49 per cent of the population used this supply in 1914 while the other 51 per cent used water from wells and springs or bottled water. The quality of these private supplies was on the average better than the public supply. In October, 1918, the city began to chlorinate the raw water. Hypochlorite was added without proper supervision and without laboratory control. This quality of water continued to be used up until March, 1925. A modern rapid sand filtration plant was then placed in operation under full time competent supervision and daily laboratory control. It was estimated in 1928 that 99.5 per cent or more of the city's population used the public supply with the remainder depending on wells.

Ashland.—For some years prior to 1910 and until September, 1920, the public water supply of Ashland was delivered from a privately owned filter plant situated on the Big Sandy River near Catlettsburg, Ky. A survey was made of the plant in 1914, at which time it was found to be inadequate to produce a water of satisfactory quality, and operated by untrained personnel and without laboratory control. The sanitary rating of the Ashland public supply was then placed at not over 25 per cent. It was being used by approximately 70 per cent of the people, while the remaining 30 per cent depended upon well, spring, and cistern water of varying quality. In September, 1920, the city completed its municipally owned water works which draws water from the Ohio River shortly above Ashland but below the mouth of the Big Sandy River. This plant is of the rapid sand filtration type with chlorination. It was not until July, 1922, that the plant was in full operation under full-time supervision and with laboratory control. By 1928 approximately 75 per cent of the inhabitants used the public supply. Persons living in the more isolated sections, or because of personal peculiarities, still depended upon wells or springs.

Ironton.—Until May, 1920, raw Ohio River water was pumped into the city public water system without any treatment. It was estimated in 1914 that only 60 per cent of the inhabitants used this supply. The remaining 40 per cent depended on wells and cisterns filled with rain water or cisterns filled with water from the public supply. In May, 1920, a modern rapid sand filtration plant with chlorination was placed in operation under competent full-time supervision and with daily laboratory control. Approximately 98.5 per cent of the people used this supply in 1928.

Portsmouth.—Raw Ohio River water used as the public supply until the close of 1914. The 1914 sanitary survey showed that approxi-

mately 90 per cent of the population used this raw water supply entirely or in part. The new modern rapid sand filtration plant with chlorination went into operation in December, 1914, under trained full-time supervision and with daily laboratory control. This supply was used by 98 per cent of the population in 1928. The remaining 2 per cent used private supplies, some of which were known to have been unsatisfactory.

TABLE A.—*The observed B. coli quality of the public water supplies of the following designated cities summarized by months for the years indicated; also a record of the reported typhoid fever cases and deaths for the corresponding months*

EAST LIVERPOOL, OHIO

Month	Number of sampling days	B. coli index per 100 c. c.			Typhoid fever	
		Days index exceeded 1 per 100 c. c.	Mean monthly index	Maximum of the observed daily indices	Reported cases	Reported deaths
1926						
January	29	19	3.92	10.0	0	0
February	28	18	3.7	10.0	0	0
March	30	19	3.3	10.0	0	0
April	30	17	2.1	8.0	0	0
May	28	0	0.0	0.0	0	0
June	27	5	0.5	6.0	0	0
July	30	2	0.16	4.0	0	0
August	28	10	1.1	10.0	0	0
September	30	12	1.37	10.0	0	0
October	30	4	0.64	10.0	0	0
November	30	9	1.01	8.6	0	0
December	29	7	0.88	6.0	1	1
1927						
January	29	6	1.05	10.0	0	0
February	27	10	2.1	8.0	0	0
March	30	13	2.34	10.0	0	0
April	28	3	0.5	4.0	0	0
May	29	6	0.61	4.0	0	0
June	20	1	0.08	2.0	0	0
July	28	1	0.05	2.0	0	0
August	31	2	0.30	4.0	0	0
September	30	3	0.59	6.0	0	0
October	24	2	0.13	2.0	0	0
November	23	5	4.1	100.0	0	0
December	29	18	3.14	10.0	0	0
1928						
January	31	18	2.32	10.0	0	0
February	29	10	1.50	10.0	0	0
March	31	6	0.38	4.0	0	0
April	30	1	0.05	2.0	0	0
May	31	0	0.00	0.0	0	0
June	30	3	0.32	4.0	0	0
July	31	7	1.08	10.0	0	0
August	31	0	0.00	0.0	2	0
September	30	0	0.00	0.0	2	0
October	31	2	0.13	2.0	0	0
November	30	6	1.07	8.0	0	0
December	31	3	0.26	4.0	0	0

TABLE A.—*The observed B. coli quality of the public water supplies of the following designated cities summarized by months for the years indicated; also a record of the reported typhoid fever cases and deaths for the corresponding months*—Continued

STEUBENVILLE, OHIO

Month	Number of sampling days	B. coli index per 100 c. c.			Typhoid fever	
		Days index exceeded 1 per 100 c. c.	Mean monthly index	Maximum of the observed daily indices	Reported cases	Reported deaths
1926						
January	27	15	1.70	6.0		0
February	22	6	0.55	2.0		0
March	27	5	0.59	6.0		0
April	22	1	0.08	2.0		0
May	28	2	0.14	2.0		0
June	28	1	0.07	2.0		0
July	21	7	1.43	8.0		0
August	27	4	0.44	4.0		0
September	22	6	1.09	10.0		0
October	19	2	0.21	2.0		0
November	26	3	0.23	2.0		0
December	26	0	0.00	0.0		0
1927						
January	25	1	0.08	2.0	1	0
February	24	0	0.0	0.0	0	0
March	27	2	0.52	8.0	0	0
April	26	0	0.0	0.0	0	0
May	23	0	0.0	0.0	0	0
June	20	0	0.0	0.0	1	0
July	21	1	0.09	2.0	0	0
August	27	0	0.0	0.0	2	0
September	25	0	0.0	0.0	3	1
October	18	0	0.0	0.0	1	1
November	27	1	0.15	4.0	0	0
December	29	1	0.07	2.0	0	0
1928						
January	23	0	0.0	0.0	0	0
February	25	0	0.0	0.0	0	0
March	28	0	0.0	0.0	0	0
April	22	0	0.0	0.0	0	0
May	28	2	0.50	8.0	0	0
June	29	2	0.14	2.0	1	0
July	31	5	0.71	6.0	0	0
August	31	3	0.39	8.0	2	1
September	22	0	0.0	0.0	1	0
October	24	0	0.0	0.0	0	0
November	16	0	0.0	0.0	0	0
December	26	1	0.15	4.0	1	0

WHEELING, W. VA.

1926						
January	31	0	0.0	0.0	3	0
February	28	0	0.0	0.0	0	1
March	31	2	0.13	2.0	0	0
April	30	0	0.0	0.0	1	0
May	31	0	0.0	0.0	0	1
June	30	10	40.20	1,000.0	2	0
July	31	0	0.0	0.0	3	0
August	31	0	0.0	0.0	4	0
September	30	20	1.33	2.0	2	0
October	31	1	0.06	2.0	1	0
November	30	0	0.0	0.0	0	0
December	31	0	0.0	0.0	0	0
1927						
January	31	5	0.32	2.0	0	0
February	28	0	0.0	0.0	0	0
March	31	0	0.0	0.0	0	0
April	30	0	0.0	0.0	0	0
May	31	1	0.06	2.0	0	0
June	30	1	0.07	2.0	1	0
July	31	5	0.32	2.0	3	0
August	31	0	0.0	0.0	2	0

TABLE A.—*The observed B. coli quality of the public water supplies of the following designated cities summarized by months for the years indicated; also a record of the reported typhoid fever cases and deaths for the corresponding months*—Continued

WHEELING, W. VA.—Continued

Month	Number of sampling days	B. coli index p 100 c. c.			Typhoid fever	
		Days index exceeded 1 per 100 c. c.	Mean monthly index	Maximum of the observed daily indices	Reported cases	Repored deaths
1927						
September	30	0	0.0	0.0	0	0
October	31	0	0.0	0.0	1	0
November	30	5	0.33	2.0	0	0
December	31	0	0.0	0.0	1	0
1928						
January	31	0	0.0	0.0	1	0
February	29	0	0.0	0.0	2	0
March	31	0	0.0	0.0	0	0
April	30	0	0.0	0.0	0	0
May	31	0	0.0	0.0	0	0
June	30	7	0.73	4.0	0	0
July	31	0	0.0	0.0	0	0
August	31	1	0.06	2.0	1	0
September	30	0	0.0	0.0	0	0
October	31	0	0.0	0.0	0	0
November	30	6	0.60	4.0	1	0
December	31	7	0.60	4.0	0	0

ASHLAND, KY.

1926						
January	31	0			1	0
February	28	0			1	0
March	31	0			0	0
April	30	0			0	0
May	31	1	0.06	2.0	0	0
June	30	0			1	0
July	31	0			2	1
August	31	0			2	1
September	30	0			0	0
October	31	0			0	0
November	30	0			0	0
December	31	0			1	0
1927						
January	31	0			0	0
February	28	0			0	0
March	31	0			0	0
April	30	0			0	0
May	31	0			0	0
June	30	0			1	0
July	31	0			9	0
August	31	0			7	1
September	30	0			0	0
October	31	0			1	0
November	30	0			4	0
December	31	0			0	0
1928						
January	31	0			1	0
February	29	0			0	0
March	31	0			0	0
April	30	0			0	0
May	31	0			3	0
June	30	0			4	0
July	31	0			5	0
August	31	0			9	0
September	30	0			5	0
October	31	0			0	0
November	30	0			0	0
December	31	0			0	0

TABLE A.—*The observed B. coli quality of the public water supplies of the following designated cities summarized by months for the years indicated; also a record of the reported typhoid fever cases and deaths for the corresponding months*—Continued

IRONTON, OHIO

Month	Number of sampling days	B. coli index per 100 c. c.			Typhoid fever	
		Days index exceeded 1 per 100 c. c.	Mean monthly index	Maximum of the observed daily indices	Reported cases	Reported deaths
1926						
January	31	1	0.06	2.0	0	0
February	28	1	0.07	2.0	0	0
March	31	1	0.06	2.0	0	0
April	30	1	0.06	2.0	0	0
May	31	0	0.0	0.0	0	0
June	30	0	0.0	0.0	0	0
July	31	0	0.0	0.0	2	0
August	31	0	0.0	0.0	2	0
September	30	1	0.07	2.0	4	0
October	31	1	0.06	2.0	3	1
November	30	1	0.06	2.0	0	0
December	30	1	0.06	2.0	0	0
1927						
January	31	0	0.0	0.0	0	0
February	28	0	0.0	0.0	0	0
March	31	0	0.0	0.0	0	0
April	30	0	0.0	0.0	0	0
May	31	0	0.0	0.0	2	0
June	30	4	0.27	2.0	0	0
July	31	1	0.06	2.0	1	0
August	31	1	0.06	2.0	3	0
September	30	1	0.07	2.0	0	0
October	31	0	0.0	0.0	0	0
November	30	0	0.0	0.0	0	0
December	31	0	0.0	0.0	0	0
1928						
January	31	1	0.06	2.0	0	0
February	29	1	0.07	2.0	0	0
March	31	0	0.0	0.0	0	0
April	30	0	0.0	0.0	0	0
May	31	0	0.0	0.0	1	0
June	30	1	0.07	2.0	0	0
July	31	4	0.26	2.0	1	0
August	31	2	0.13	2.0	2	0
September	30	7	0.40	2.0	1	0
October	31	2	0.13	2.0	0	0
November	30	1	0.06	2.0	0	0
December	31	2	0.13	2.0	0	0

PORTSMOUTH, OHIO

1926						
January	31	0	0.00	0.0	1	0
February	28	1	0.07	2.0	0	0
March	31	0	0.00	0.0	0	0
April	30	0	0.00	0.0	1	0
May	31	0	0.00	0.0	3	0
June	30	0	0.00	0.0	1	1
July	30	0	0.00	0.0	3	0
August	31	1	0.07	2.0	4	1
September	14	2	0.14	2.0	1	0
October	31	2	0.13	2.0	0	0
November	30	0	0.00	0.0	1	0
December	30	0	0.00	0.0	0	0
1927						
January	31	0	0.0	0.0	0	0
February	28	0	0.0	0.0	0	0
March	31	0	0.0	0.0	0	0
April	29	0	0.0	0.0	0	0
May	31	0	0.0	0.0	0	0
June	30	0	0.0	0.0	2	0
July	31	1	0.07	2.0	2	0
August	30	1	0.07	2.0	1	0

TABLE A.—*The observed B. coli quality of the public water supplies of the following designated cities summarized by months for the years indicated; also a record of the reported typhoid fever cases and deaths for the corresponding months*—Continued

PORTSMOUTH, OHIO—Continued

Month	Number of sampling days	B. coli index per 100 c. c.			Typhoid fever	
		Days index exceeded 1 per 100 c. c.	Mean monthly index	Maximum of the observed daily indices	Reported cases	Reported deaths
1927						
September	30	2	0.13	2.0	2	0
October	31	0	0.00	0.0	1	0
November	30	2	0.13	2.0	1	0
December	30	1	0.07	2.0	0	0
1928						
January	31	3	0.19	2.0	0	0
February	29	1	0.07	2.0	0	0
March	31	0	0.00	0.0	0	0
April	30	1	0.07	2.0	0	0
May	31	0	0.00	0.0	3	0
June	30	1	0.07	2.0	1	0
July	31	0	0.00	0.0	3	1
August	31	1	0.07	2.0	3	1
September	30	1	0.06	2.0	7	0
October	31	0	0.00	0.0	4	1
November	30	0	0.00	0.0	4	2
December	30	0	0.00	0.0	1	0

TABLE B.—*The estimated annual populations for the six Ohio River cities included in the present study (estimates based on the 1910, 1920, and 1930 Federal Census)*

Year	Population estimated as of July 1						Combined population
	East Liverpool	Steubenville	Wheeling	Ashland	Ironton	Portsmouth	
1910	20,410	22,523	41,641	----------	13,165	23,685	121,424
1911	20,518	23,159	41,628	9,442	13,252	24,666	132,665
1912	20,626	23,795	41,614	10,066	13,339	25,648	135,088
1913	20,734	24,431	41,601	10,690	13,426	26,624	137,506
1914	20,842	25,067	41,587	11,314	13,513	27,611	139,934
1915	20,950	25,703	41,574	11,938	13,600	28,592	142,357
1916	21,058	26,339	41,560	12,562	13,687	29,574	144,780
1917	21,166	26,975	41,547	13,186	13,774	30,555	147,203
1918	21,274	27,611	41,533	13,810	13,861	31,537	149,626
1919	21,382	28,247	41,520	14,434	13,948	32,518	152,049
1920	21,490	28,883	56,208	15,058	14,035	33,502	169,176
1921	21,665	29,555	56,784	21,193	14,299	34,438	177,934
1922	21,840	30,227	57,360	22,093	14,565	35,374	181,459
1923	22,015	30,899	57,936	22,993	14,827	36,310	184,980
1924	22,190	31,571	58,512	23,893	15,091	37,246	188,503
1925	22,365	32,243	59,088	24,793	15,355	38,182	192,026
1926	22,540	32,915	59,664	25,693	15,619	39,118	195,549
1927	22,715	33,587	60,240	26,593	15,883	40,054	199,072
1928	22,890	34,259	60,816	27,493	16,147	40,990	202,595

DEATHS DURING WEEK ENDED MAY 30, 1931

Summary of information received by telegraph from industrial insurance companies for the week ended May 30, 1931, and corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

	Week ended May 30, 1931	Corresponding week, 1930
Policies in force	75,152,855	75,782,122
Number of death claims	13,756	11,132
Death claims per 1,000 policies in force, annual rate	9.5	7.7

Deaths [1] from all causes in certain large cities of the United States during the week ended May 30, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

[The rates published in this summary are based upon midyear population estimates derived from the 1930 census]

City	Week ended May 30, 1931				Corresponding week, 1930		Death rate [2] for first 22 weeks	
	Total deaths	Death rate [2]	Deaths under 1 year	Infant mortality rate [3]	Death rate [2]	Deaths under 1 year	1931	1930
Total (81 cities)	7,652	11.2	605	[4] 46	11.0	681	13.3	13.0
Akron	34	6.9	5	49	5.7	3	8.4	8.4
Albany [5]	42	17.0	4	79	8.2	0	15.2	16.3
Atlanta	97	18.2	5	51	15.4	6	16.3	16.6
White	52		4	63		4		
Colored	45	(6)	1	29	(6)	2	(6)	(6)
Baltimore [5]	200	12.8	8	27	12.7	20	16.3	15.4
White	145		2	9		13		
Colored	55	(6)	6	94	(6)	7	(6)	(6)
Birmingham	73	14.1	7	70	12.4	3	15.0	14.2
White	36		4	69		2		
Colored	37	(6)	3	73	(6)	1	(6)	(6)
Boston	184	12.2	11	31	13.4	20	16.0	16.0
Bridgeport	29	10.3	2	33	9.9	1	12.3	13.0
Buffalo	126	11.3	12	49	11.5	13	14.6	14.4
Cambridge	23	10.5	0	0	6.9	2	13.9	13.5
Camden	23	10.1	3	52	11.0	1	16.6	14.7
Canton	22	10.7	2	46	5.4	2	11.2	11.1
Chicago [5]	686	10.3	39	34	9.3	51	11.6	11.4
Cincinnati	125	14.3	14	84	9.9	8	17.2	16.6
Cleveland	174	9.9	15	44	10.6	17	12.2	12.3
Columbus	82	14.5	4	39	14.8	8	15.0	17.9
Dallas	49	9.4	9		11.5	10	12.3	12.1
White	34		7			6		
Colored	15	(6)	2		(6)	4	(6)	(6)
Dayton	60	15.1	6	84	7.7	3	13.1	10.3
Denver	71	12.7	6	58	14.1	7	15.2	15.4
Des Moines	29	10.5	5	88	11.3	1	11.8	12.6
Detroit	250	7.9	30	48	8.2	32	9.3	10.4
Duluth	20	10.2	0	0	12.8	6	11.5	11.5
El Paso	28	13.9	6		20.8	10	17.5	18.7
Erie	19	8.4	4	75	9.4	3	11.5	11.4
Fall River [5] [7]	41	18.5	5	113	12.2	3	13.6	13.9
Flint	26	8.3	2	26	6.3	4	8.1	10.1
Fort Worth	30	9.3	4		12.4	4	12.3	11.7
White	25		4			2		
Colored	5	(6)	0		(6)	2	(6)	(6)
Grand Rapids	33	10.0	3	44	9.2	3	9.7	11.4
Houston	69	11.6	7		13.4	11	11.6	12.8
White	40		5			7		
Colored	29	(6)	2		(6)	4	(6)	(6)
Indianapolis	87	12.3	6	49	11.3	4	14.8	15.5
White	76		6	56		3		
Colored	11	(6)	0	0	(6)	1	(6)	(6)
Jersey City	59	9.6	9	80	9.2	7	12.9	12.8
Kansas City, Kans	32	13.6	2	41	6.4	1	14.5	12.0
White	21		1	25		1		
Colored	11	(6)	1	127	(6)	0	(6)	(6)
Kansas City, Mo	88	11.2	13	99	11.7	7	14.6	13.9
Knoxville	20	9.5	2	43	14.2	5	13.8	15.2
White	15		2	48		5		
Colored	5	(6)	0	0	(6)	0	(6)	(6)
Long Beach	29	9.9	1	24	10.1	0	10.5	10.4
Los Angeles	273	10.8	25	73	8.6	17	11.5	11.5
Louisville	96	16.2	3	26	10.8	2	15.9	14.3
White	69		1	10		2		
Colored	27	(6)	2	133	(6)	0	(6)	(6)
Lowell [7]	21	10.9	4	102	14.0	1	13.6	14.8
Lynn	19	9.6	0	0	7.1	5	11.4	11.9
Memphis	81	16.3	7	74	16.6	10	17.6	18.1
White	42		1	17		5		
Colored	39	(6)	6	174	(6)	5	(6)	(6)

See footnotes at end of table.

Deaths [1] from all causes in certain large cities of the United States during the week ended May 30, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)—Continued

City	Week ended May 30, 1931				Corresponding week, 1930		Death rate [2] for first 22 weeks	
	Total deaths	Death rate [2]	Deaths under 1 year	Infant mortality rate [3]	Death rate [2]	Deaths under 1 year	1931	1930
Miami	19	8.8	1	25	7.0	1	13.7	12.3
White	11		0	0		1		
Colored	8	(8)	1	88	(8)	0	(8)	(8)
Milwaukee	107	9.5	14	61	7.2	7	10.2	10.6
Minneapolis	87	9.6	4	26	8.9	8	11.9	11.2
Nashville	47	15.8	8	119	13.2	4	17.6	16.6
White	27		2	40		2		
Colored	20	(8)	6	354	(8)	2	(8)	(8)
New Bedford [7]	20	9.3	0	0	13.9	5	13.6	12.1
New Haven	39	12.5	5	95	13.8	3	13.2	14.8
New Orleans	127	14.2	7	38	16.4	10	18.3	18.9
White	83		2	17		8		
Colored	44	(8)	5	81	(8)	2	(8)	(8)
New York	1,439	10.6	116	48	10.6	127	12.8	12.1
Bronx Borough	191	7.5	14	32	8.3	8	9.2	8.6
Brooklyn Borough	460	9.1	41	43	9.0	52	11.8	11.1
Manhattan Borough	592	17.0	49	83	16.5	55	19.6	18.0
Queens Borough	147	6.6	10	27	6.8	11	8.2	7.8
Richmond Borough	49	15.6	2	36	11.8	1	14.3	15.0
Newark, N. J	83	9.7	9	47	10.4	7	13.1	13.8
Oakland	53	9.5	3	38	12.8	5	11.4	11.7
Oklahoma City	35	9.3	1	14	10.0	4	12.2	10.2
Omaha	82	19.7	6	67	13.1	4	14.8	14.0
Paterson	28	10.5	1	17	11.7	4	15.0	13.7
Philadelphia	445	11.8	45	65	12.0	43	15.2	13.8
Pittsburgh	143	11.0	11	38	14.4	20	16.8	15.4
Portland, Oreg	70	11.9	4	49	12.7	1	12.6	13.2
Providence	62	12.7	1	9	12.6	4	14.7	15.1
Richmond	47	13.3	3	44	12.5	7	17.1	16.1
White	22		1	22		4		
Colored	25	(8)	2	87	(8)	3	(8)	(8)
Rochester	63	9.9	6	55	8.7	5	13.4	12.7
St. Louis	192	12.1	6	20	13.0	12	16.9	14.7
St. Paul	55	10.4	1	10	9.9	3	11.5	10.9
Salt Lake City [4]	40	14.6	3	45	11.9	4	13.3	13.8
San Antonio	83	18.0	22		23.7	32	16.1	18.5
San Diego	49	16.3	0	0	13.6	1	15.0	15.0
San Francisco	126	10.1	0	0	12.7	7	13.9	13.8
Schenectady	14	7.6	0	0	12.5	1	11.4	12.6
Seattle	82	11.5	3	28	10.2	2	12.6	11.7
Somerville	19	9.4	1	37	7.0	0	10.9	11.7
South Bend	17	8.2	0	0	8.4	3	8.9	9.6
Spokane	32	14.3	2	52	11.7	1	13.0	13.4
Springfield, Mass	33	11.3	0	0	11.1	2	13.8	13.8
Syracuse	51	12.5	4	47	15.6	4	12.7	13.1
Tacoma	25	12.1	1	26	11.7	3	14.0	13.2
Toledo	60	10.6	7	64	9.7	1	12.9	13.8
Trenton	46	19.4	2	35	17.3	8	19.2	17.7
Utica	27	13.8	2	52	11.8	3	15.8	17.0
Washington, D. C	137	14.5	8	44	13.0	5	17.5	16.0
White	83		4	33		2		
Colored	54	(8)	4	69	(8)	3	(8)	(8)
Waterbury	13	6.7	1	30	5.7	0	10.8	10.3
Wilmington, Del. [7]	21	10.3	0	0	16.1	1	15.9	15.6
Worcester	43	11.4	5	69	11.7	4	14.4	14.8
Yonkers	18	6.8	0	0	3.1	0	9.5	8.8
Youngstown	23	6.9	2	28	9.2	4	11.1	11.1

[1] Deaths of nonresidents are included. Stillbirths are excluded.

[2] These rates represent annual rates per 1,000 population, as estimated for 1931 and 1930 by the arithmetical method.

[3] Deaths under 1 year of age per 1,000 live births. Cities left blank are not in the registration area for births.

[4] Data for 76 cities.

[5] Deaths for week ended Friday.

[6] For the cities for which deaths are shown by color, the percentage of colored population in 1920 was as follows: Atlanta, 31; Baltimore, 15; Birmingham, 39; Dallas, 15; Fort Worth, 14; Houston, 25; Indianapolis, 11; Kansas City, Kans., 14; Knoxville, 15; Louisville, 17; Memphis, 38; Miami, 31; Nashville, 30; New Orleans, 26; Richmond, 32; and Washington, D. C., 25.

[7] Population Apr. 1, 1930; decreased 1920 to 1930; no estimate made.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended June 6, 1931, and June 7, 1930

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 6, 1931, and June 7, 1930

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930
New England States:								
Maine	4	7	3	----	34	69	0	2
New Hampshire	1	----	----	----	58	50	1	1
Vermont	1	----	----	----	1	44	0	0
Massachusetts	50	61	2	3	645	1,335	4	2
Rhode Island	9	6	----	----	111	38	0	0
Connecticut	6	14	1	8	391	30	1	0
Middle Atlantic States:								
New York	159	118	[1] 8	[1] 8	3,174	2,574	11	8
New Jersey	37	137	20	6	943	1,596	3	6
Pennsylvania	76	72	----	----	2,874	776	9	9
East North Central States:								
Ohio	17	33	14	3	857	337	0	3
Indiana	18	15	----	----	521	144	2	3
Illinois	124	171	5	61	1,970	629	16	7
Michigan	29	61	4	----	401	1,347	5	26
Wisconsin	18	17	17	2	788	644	1	3
West North Central States:								
Minnesota	12	6	----	----	240	144	4	0
Iowa	6	6	----	----	62	166	0	0
Missouri	21	24	2	----	238	60	4	6
North Dakota	2	3	----	----	65	19	1	0
South Dakota	2	2	1	----	17	62	1	0
Nebraska	0	3	----	----	2	125	2	0
Kansas	5	10	1	----	131	318	1	1
South Atlantic States:								
Delaware	----	1	----	1	80	3	0	0
Maryland [2] [3]	18	15	2	5	740	44	3	1
District of Columbia	5	12	----	2	107	79	1	0
West Virginia	7	6	24	1	198	59	2	1
North Carolina	14	11	8	2	868	54	1	1
South Carolina	13	6	282	114	171	----	1	1
Georgia	3	2	35	13	111	184	0	2
Florida [2]	1	4	4	----	161	60	1	0

[1] New York City only.
[2] Week ended Friday.
[3] Typhus fever: 1931, 4 cases; 1 case in Maryland; 1 case in Florida; 1 case in Alabama; and 1 case in Texas.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 6, 1931, and June 7, 1930—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930
East South Central States:								
Kentucky	8				181	21	2	1
Tennessee	5	3	17	5	366	94	1	7
Alabama [3]	8	8	14	13	104	130	0	4
Mississippi	6	5					5	3
West South Central States:								
Arkansas	2	3	11	1	53	31	0	1
Louisiana	18	8	12	16	8	23	1	4
Oklahoma [4]	10	5	46	15	77	94	0	0
Texas [3]	14	8	31	23	89	183	1	1
Mountain States:								
Montana	1				37	46	2	1
Idaho	3	1			4	21	0	1
Wyoming	5	1			3	54	0	0
Colorado	10	8			474	503	2	0
New Mexico	10	11		1	51	62	0	1
Arizona			2	3	38	66	1	7
Utah [2]	1		1	6	4	212	1	3
Pacific States:								
Washington	4	3			132	727	0	1
Oregon	6	5	6	8	64	105	0	1
California	58	58	36	20	935	1,934	1	7

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930
New England States:								
Maine	0	0	38	8	0	0	0	1
New Hampshire	0	0	0	13	0	0	0	0
Vermont	0	0	3	5	4	1	0	0
Massachusetts	3	0	264	218	0	0	3	8
Rhode Island	0	0	34	19	0	0	0	0
Connecticut	1	0	37	48	0	0	2	2
Middle Atlantic States:								
New York	1	0	746	402	5	3	14	20
New Jersey	1	1	279	202	0	0	5	6
Pennsylvania	1	2	518	210	0	0	8	10
East North Central States:								
Ohio	0	1	308	157	17	74	9	7
Indiana	0	0	155	88	121	96	2	19
Illinois	0	1	473	391	29	119	8	15
Michigan	1	0	395	273	17	39	4	2
Wisconsin	0	1	104	84	6	6	0	5
West North Central States:								
Minnesota	0	0	58	60	11	4	3	2
Iowa	1	0	48	37	64	97	3	3
Missouri	1	0	150	103	51	39	8	3
North Dakota	0	0	19	8	16	27	1	0
South Dakota	0	0	8	5	19	41	0	0
Nebraska	0	0	31	29	30	53	0	1
Kansas	1	0	23	48	57	53	2	5
South Atlantic States:								
Delaware	0	0	9	5	0	0	0	1
Maryland [2] [3]	0	0	51	71	0	0	6	5
District of Columbia	0	0	16	4	0	0	0	3
West Virginia	1	0	19	15	7	29	5	10
North Carolina	0	5	15	16	4	7	17	16
South Carolina	1	2	0	4	7	4	19	45
Georgia	1	0	41	19	0	0	19	18
Florida [3]	0	0	4	1	0	0	1	1

[2] Week ended Friday.
[3] Typhus fever: 1931, 4 cases; 1 case in Maryland; 1 case in Florida; 1 case in Alabama; and 1 case in Texas.
[4] Exclusive of Oklahoma City and Tulsa.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 6, 1931, and June 7, 1930—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930	Week ended June 6, 1931	Week ended June 7, 1930
East South Central States:								
Kentucky	0	0	55	27	5	20	6	5
Tennessee	0	0	12	41	25	25	6	14
Alabama	1	2	11	8	28	7	11	8
Mississippi	0	1	9	4	37	4	17	24
West South Central States:								
Arkansas	0	1	13	2	31	2	9	12
Louisiana	0	0	8	19	27	26	12	30
Oklahoma [4]	0	0	15	27	81	80	3	9
Texas [3]	0	1	28	18	79	37	10	12
Mountain States:								
Montana	0	0	25	28	0	7	3	2
Idaho	0	0	6	2	2	3	0	0
Wyoming	0	0	10	1	0	14	0	0
Colorado	0	0	20	10	22	7	4	0
New Mexico	0	1	5	8	0	9	0	0
Arizona	0	0	0	6	2	6	3	4
Utah [3]	2	0	2	8	0	1	0	0
Pacific States:								
Washington	0	1	26	15	21	64	5	1
Oregon	0	1	19	14	23	18	4	2
California	9	31	97	114	24	46	10	12

[3] Week ended Friday.
[3] Typhus fever: 1931, 4 cases; 1 case in Maryland; 1 case in Florida; 1 case in Alabama; and 1 case in Texas.
[4] Exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
March, 1931										
Delaware	----	11	46	----	388	----	0	101	0	1
April, 1931										
Delaware	----	7	3	----	1,036	----	0	158	0	1
Florida	10	28	123	13	1,040	3	1	23	4	16
May, 1931										
Arizona	3	13	12	----	215	2	1	11	0	10
Connecticut	5	39	14	1	2,414	----	1	200	0	9
Delaware	1	2	----	----	539	----	0	64	0	3
District of Columbia	7	37	10	----	1,222	1	0	76	0	3
Florida	2	19	10	9	764	12	1	20	5	12
Porto Rico	----	32	378	1,487	27	6	1	----	0	14
Wyoming	----	----	1	----	6	----	0	45	2	----

March, 1931

Delaware:	Cases
Chicken pox	21
Mumps	101
Rabies in animals	2
Undulant fever	1
Whooping cough	9

April, 1931

Chicken pox:	
Delaware	25
Florida	273
Dysentery:	
Florida	2
Mumps:	
Delaware	122
Florida	42
Rabies in animals:	
Delaware	8
Florida	1
Whooping cough:	
Delaware	8
Florida	121

May, 1931

Chicken pox:	
Arizona	26
Connecticut	392
Delaware	18
District of Columbia	86
Florida	161
Porto Rico	10
Wyoming	35
Colibacillosis:	
Porto Rico	1
Conjunctivitis:	
Connecticut	10
Wyoming	1
Dengue:	
Porto Rico	1
Dysentery:	
Arizona	16
Florida	5
Porto Rico	29
Filariasis:	
Porto Rico	2
German measles:	
Connecticut	41
Lead poisoning:	
Connecticut	1
Lethargic encephalitis:	
Connecticut	3
Mumps:	
Arizona	15
Connecticut	276
Delaware	34
Florida	43
Porto Rico	1
Wyoming	72
Ophthalmia neonatorum:	
Porto Rico	7
Paratyphoid fever:	
Porto Rico	2
Puerperal septicemia:	
Porto Rico	6
Rabies in animals:	
Connecticut	5
Delaware	4
Rocky Mountain spotted or tick fever:	
Wyoming	8
Septic sore throat:	
Connecticut	10
Wyoming	1
Tetanus:	
Connecticut	1
Porto Rico	5
Tetanus (infantile):	
Porto Rico	24
Trachoma:	
Arizona	10
Porto Rico	1
Trichinosis:	
Connecticut	7
Undulant fever:	
Connecticut	2
Whooping cough:	
Arizona	32
Connecticut	172
Delaware	13
District of Columbia	35
Florida	71
Porto Rico	316
Wyoming	32

PLAGUE-INFECTED GROUND SQUIRRELS IN CALIFORNIA

The director of public health of California reported, under date of May 25, 1931, that plague had been proved by animal inoculation in four ground squirrels from a ranch 21 miles southeast of King City, Monterey County, Calif.

On June 2, 1931, he reported that plague infection had been proved in two ground squirrels from a ranch 6 miles east of San Lucas, Monterey County.

The last previous plague-infected ground squirrel in California was reported in December, 1929, from Santa Clara County.

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 97 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 33,370,000. The estimated population of the 90 cities reporting deaths is more than 31,825,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemic.

Weeks ended May 30, 1931, and May 31, 1930

	1931	1930	Estimated expectancy
Cases reported			
Diphtheria:			
46 States	765	927	----
97 cities	378	476	736
Measles:			
43 States	18,655	14,229	----
97 cities	7,142	5,747	----
Meningococcus meningitis:			
46 States	99	131	----
97 cities	51	55	----
Poliomyelitis:			
46 States	23	41	----
Scarlet fever:			
46 States	4,571	2,696	----
97 cities	1,957	1,140	1,186
Smallpox:			
46 States	776	750	----
97 cities	94	96	49
Typhoid fever:			
46 States	208	226	----
97 cities	43	44	40
Deaths reported			
Influenza and pneumonia:			
90 cities	658	495	----
Smallpox:			
90 cities	1	0	----
Fort Worth, Tex	1	0	----

City reports for week ended May 30, 1931

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence the number of cases of the disease under consideration that may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding weeks of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded, and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If the reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1922 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviation from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland	4	1	0		0	0	9	2
New Hampshire:								
Concord	0	0	0		0	13	0	1
Vermont:								
Barre	0	0	0		0	0	0	0
Massachusetts:								
Boston	49	31	10		0	62	12	20
Fall River	3	2	0	1	1	20	6	7
Springfield	10	2	0	1	1	12	11	0
Worcester	11	2	6		0	3	23	3
Rhode Island:								
Pawtucket	0	1	1		0	0	0	0
Providence	7	5	3		0	97	20	4
Connecticut:								
Bridgeport	2	4	1	1	1	2	8	3
Hartford	5	4	0	1	1	2	1	4
New Haven	45	1	0		0	178	10	2
MIDDLE ATLANTIC								
New York:								
Buffalo	14	9	6		0	282	36	11
New York	262	241	100	9	4	1,419	64	145
Rochester	8	5	0		0	123	14	3
Syracuse	32	3	0		0	10	1	1
New Jersey:								
Camden	1	6	1		0	1	0	5
Newark	106	13	4	2	0	21	6	9
Trenton	3	2	1		0	4	3	1
Pennsylvania:								
Philadelphia	148	56	7	4	0	713	31	34
Pittsburgh	33	15	11	1	2	78	60	30
Reading	11	1	0		0	5	6	4
EAST NORTH CENTRAL								
Ohio:								
Cincinnati	8	5	1		0	106	22	12
Cleveland	203	22	10	2	0	325	378	14
Columbus	33	3	1	1	1	17	3	5
Toledo	39	3	5	1	1	7	17	4
Indiana:								
Fort Wayne	6	1	1		0	9	0	4
Indianapolis	42	2	5		0	367	47	13
South Bend		0						
Terre Haute	1	0	1		0	14	0	0
Illinois:								
Chicago	165	81	81	3	5	760	69	44
Springfield	15	0	0		0	22	7	3
Michigan:								
Detroit	127	40	30	4	2	21	61	18
Flint	51	2	3		0	4	9	2
Grand Rapids	4	0	0		0	43	0	4

City reports for week ended May 30, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST NORTH CENTRAL—con.								
Wisconsin:								
Kenosha	0	0	0		0	1	162	0
Madison	6	0	1			2	40	
Milwaukee	112	11	1	1	1	440	454	4
Racine	7	0	0		0	4	25	0
Superior	3	0	0		0	0	0	0
WEST NORTH CENTRAL								
Minnesota:								
Duluth	10	0	0		0	0	5	3
Minneapolis	149	11	7		1	96	133	6
St. Paul	90	7	0	1	1	60	3	2
Iowa:								
Davenport	0	0	0			0	0	
Des Moines	0	1	0			0	0	
Sioux City	15	1	3			3	24	
Waterloo	1	0	0			1	0	
Missouri:								
Kansas City	11	3	1		1	153	6	14
St. Joseph	1	0	7		0	4	2	1
St. Louis	34	30	9	1		7	17	6
North Dakota:								
Fargo	1	0	0		0	4	7	0
Grand Forks	0	0	0			0	0	
South Dakota:								
Aberdeen	3	0	0			13	0	
Nebraska:								
Omaha	38	2	1		0	0	27	11
Kansas:								
Topeka	9	1	0	1	0	1	44	1
Wichita	9	1	0		0	6	1	1
SOUTH ATLANTIC								
Delaware:								
Wilmington	1	0	2		0	17	1	1
Maryland:								
Baltimore	66	20	6	1	2	487	53	21
Cumberland	2	0	0		0	2	0	1
Frederick	1	0	0		0	12	0	0
District of Columbia:								
Washington	20	10	9		0	202	0	7
Virginia:								
Lynchburg	20	1	0		0	2	0	0
Norfolk	1	0	0		0	70	0	1
Richmond	0	1	1		3	89	0	3
Roanoke	7	1	0		0	12	4	1
West Virginia:								
Charleston	2	0	0		0	0	0	2
Wheeling	7	0	0		0	2	0	2
North Carolina:								
Raleigh	1	0	0		0	70	0	1
Wilmington	1	0	0		0	1	0	3
Winston-Salem	1	0	0		0	109	15	3
South Carolina:								
Charleston	0	0	0	18	0	2	0	4
Columbia	0	0	0		0	1	0	6
Greenville	0	0	0		0	0	0	0
Georgia:								
Atlanta	8	2	2	6	2	26	5	8
Brunswick	0	0	0		0	0	8	0
Savannah	2	0	1	6	2	1	5	3
Florida:								
Miami	1	2	2	1	0	101	1	3
Tampa	1	1	0		0	23	0	1

City reports for week ended May 30, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST SOUTH CENTRAL								
Kentucky:								
Covington	0	0	0	----	0	1	1	2
Tennessee:								
Memphis	16	0	2	----	1	120	2	10
Nashville	1	0	0	----	0	55	0	6
Alabama:								
Birmingham	2	1	0	4	2	3	1	8
Mobile	0	0	1	----	0	0	0	3
Montgomery	0	0	0	----	----	1	1	----
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith	3	0	0	----	----	1	0	----
Little Rock	2	0	0	----	1	15	3	3
Louisiana:								
New Orleans	6	7	13	1	1	2	0	9
Shreveport	4	0	0	----	0	7	4	2
Oklahoma:								
Muskogee	12	0	0	----	0	1	2	0
Oklahoma City	1	1	0	4	0	3	0	7
Tulsa	5	0	0	----	----	9	1	----
Texas:								
Dallas	43	3	1	----	1	14	10	3
Forth Worth	25	1	1	----	0	2	0	4
Galveston	0	0	0	----	0	0	0	3
Houston	0	3	1	----	0	11	3	4
San Antonio	1	1	1	----	1	37	1	13
MOUNTAIN								
Montana:								
Billings	5	0	0	----	0	3	0	0
Great Falls	2	0	1	----	0	1	0	0
Helena	0	0	0	----	0	1	0	0
Missoula	7	0	0	----	0	0	0	1
Idaho:								
Boise	1	0	0	----	0	0	0	0
Colorado:								
Denver	24	8	5	----	2	33	22	5
Pueblo	0	1	0	----	0	12	0	0
New Mexico:								
Albuquerque	6	0	0	----	0	4	0	0
Arizona:								
Phoenix	0	0	0	----	0	2	0	0
Utah:								
Salt Lake City	19	2	0	----	0	1	6	1
Nevada:								
Reno	0	0	0	----	0	2	0	1
PACIFIC								
Washington:								
Seattle	61	2	0	----	----	11	15	----
Spokane	8	2	0	----	----	1	0	----
Tacoma	6	1	0	----	0	0	5	1
Oregon:								
Portland	9	4	0	----	1	17	11	2
Salem	10	0	0	----	0	3	16	0
California:								
Los Angeles	39	28	13	20	2	92	8	9
Sacramento	5	2	0	----	0	45	4	3
San Francisco	37	13	6	4	0	102	7	5

City reports for week ended May 30, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
NEW ENGLAND											
Maine:											
Portland	13	3	0	0	0	0	0	0	0	2	20
New Hampshire:											
Concord	1	0	0	0	0	1	0	0	0	0	11
Vermont:											
Barre	0	0	0	0	0	0	0	0	0	0	2
Massachusetts:											
Boston	67	80	0	0	0	9	2	1	0	20	184
Fall River	3	3	0	0	0	2	0	0	0	6	41
Springfield	7	17	0	0	0	2	0	0	0	6	31
Worcester	8	17	0	0	0	2	0	0	0	6	43
Rhode Island:											
Pawtucket	3	0	0	0	0	0	0	0	0	0	18
Providence	10	24	0	0	0	2	0	0	0	5	62
Connecticut:											
Bridgeport	8	0	0	0	0	1	0	0	0	0	29
Hartford	4	2	0	0	0	2	1	0	0	1	34
New Haven	5	0	0	0	0	3	0	0	0	3	39
MIDDLE ATLANTIC											
New York:											
Buffalo	23	33	0	2	0	11	0	0	0	20	123
New York	249	313	0	0	0	114	9	18	2	128	1,439
Rochester	9	44	0	0	0	1	1	0	0	5	58
Syracuse	8	20	0	0	0	1	0	0	0	11	51
New Jersey:											
Camden	5	3	0	0	0	1	1	0	0	5	23
Newark	24	38	0	0	0	7	0	0	0	61	86
Trenton	3	4	0	0	0	2	0	1	0	0	46
Pennsylvania:											
Philadelphia	87	164	0	0	0	34	2	0	0	38	445
Pittsburgh	27	62	0	0	0	8	0	0	0	24	143
Reading	4	0	0	0	0	4	0	0	0	0	21
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	14	55	2	1	0	14	0	0	0	4	125
Cleveland	38	93	0	1	0	15	1	0	1	41	174
Columbus [1]	7	8	0	0	0	7	0	1	0	1	82
Toledo	11	10	1	0	0	6	0	0	0	15	60
Indiana:											
Fort Wayne	3	5	2	0	0	4	0	0	0	1	38
Indianapolis	13	40	7	9	0	3	0	0	0	51	----
South Bend	4	----	0	----	----	----	0	----	----	----	----
Terre Haute	2	4	1	1	0	0	0	0	0	3	17
Illinois:											
Chicago	108	261	2	0	0	55	3	1	1	58	686
Springfield	3	1	0	0	0	0	0	0	0	0	34
Michigan:											
Detroit	106	177	1	0	0	18	1	1	0	99	250
Flint	11	20	1	1	0	4	0	0	0	16	26
Grand Rapids	9	9	0	0	0	2	0	0	0	17	33
Wisconsin:											
Kenosha	2	14	0	0	0	0	0	0	0	4	4
Madison	1	1	0	1	----	----	0	0	----	2	----
Milwaukee	29	20	0	0	0	9	1	0	0	27	107
Racine	3	4	0	0	0	2	0	0	0	21	17
Superior	2	5	0	0	0	0	0	0	0	0	7
WEST NORTH CENTRAL											
Minnesota:											
Duluth	7	0	0	0	0	0	0	0	0	0	20
Minneapolis	29	13	0	1	0	0	0	0	0	19	87
St. Paul	19	12	0	1	0	4	0	0	0	23	94

[1] The report of 3 deaths from typhoid fever at Columbus during the week ended May 9, 1931, was erroneous, no deaths having occurred.

City reports for week ended May 30, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST NORTH CENTRAL—continued											
Iowa:											
Davenport	1	2	1	10			0	0		4	
Des Moines	7	7	2	12			0	0		0	29
Sioux City	1	8	0	5			0	0		12	
Waterloo	2	6	0	0			0	0		5	
Missouri:											
Kansas City	13	4	1	2	0	4	1	1	0	8	88
St. Joseph	2	6	0	1	0	0	0	0	0	0	22
St. Louis	27	91	2	5	0	19	1	0	0	27	192
North Dakota:											
Fargo	1	2	0	0	0	0	0	0	0	3	
Grand Forks	1	0	0	0			0	1		0	
South Dakota:											
Aberdeen	1	0	0	1			0	0		0	
Nebraska:											
Omaha	3	9	3	17	0	3	0	1	0	7	67
Kansas:											
Topeka	3	0	0	4	0	1	0	0	0	3	19
Wichita	3	1	0	10	0	1	0	0	0	6	27
SOUTH ATLANTIC											
Delaware:											
Wilmington	3	4	0	0	0	1	0	0	0	5	21
Maryland:											
Baltimore	35	29	0	0	0	18	2	2	0	37	200
Cumberland	0	0	0	0	0	0	0	1	0	0	4
Frederick	0	0	0	0	0	0	0	0	0	0	5
District of Col.:											
Washington	20	25	0	0	0	14	0	0	0	11	137
Virginia:											
Lynchburg	0	0	0	0	0	1	0	1	0	0	12
Norfolk	1	0	0	0	0	2	1	0	0	5	
Richmond	2	9	0	0	0	7	0	0	0	0	53
Roanoke	0	0	0	0	0	0	0	0	0	6	13
West Virginia:											
Charleston	0	0	0	0	0	2	1	0	0	1	26
Wheeling	1	2	0	0	0	0	0	0	0	1	16
North Carolina:											
Raleigh	0	0	0	0	0	1	0	1	0	27	14
Wilmington	0	0	0	0	0	2	0	0	0	17	11
Winston-Salem	0	1	1	0	0	3	0	0	0	12	24
South Carolina:											
Charleston	0	0	1	0	0	1	1	2	0	0	27
Columbia	0	0	0	0	0	0	1	0	0	0	32
Greenville	0	0	0	0	0	0	0	0	0	2	
Georgia:											
Atlanta	3	51	2	12	0	5	1	2	2	9	97
Brunswick	0	0	0	0	0	1	0	0	0	0	3
Savannah	0	0	0	0	0	2	0	2	0	1	42
Florida:											
Miami	0	0	0	0	0	2	0	0	0	2	19
Tampa	1	0	0	0	0	0	0	0	0	1	17
EAST SOUTH CENTRAL											
Kentucky:											
Covington	1	9	1	0	0	1	0	0	0	1	17
Tennessee:											
Memphis	4	27	0	0	0	4	2	2	0	36	81
Nashville	2	7	2	0	0	0	1	0	0	6	47
Alabama:											
Birmingham	1	6	2	0	0	7	1	0	0	7	73
Mobile	0	0	0	1	0	1	0	0	0	0	22
Montgomery	1	2	0	0			0	0		1	

City reports for week ended May 30, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	0	0	0	0	----	----	0	0	----	0	----
Little Rock	1	1	0	0	0	2	0	0	0	0	6
Louisiana:											
New Orleans	7	8	0	7	0	7	2	0	0	2	127
Shreveport	1	0	0	0	0	5	0	0	0	4	40
Oklahoma:											
Muskogee	0	0	2	0	0	0	0	0	0	1	----
Oklahoma City	3	0	2	0	0	3	1	0	0	0	35
Tulsa	1	0	1	24	----	----	0	0	----	2	----
Texas:											
Dallas	2	1	1	3	0	1	1	0	0	10	49
Fort Worth	2	2	2	7	1	1	0	0	0	15	30
Galveston	0	0	0	1	0	0	0	0	0	0	14
Houston	2	4	1	0	0	8	0	1	0	0	69
San Antonio	0	1	0	0	0	4	0	1	0	0	83
MOUNTAIN											
Montana:											
Billings	0	0	0	0	0	0	0	0	0	2	4
Great Falls	1	4	0	0	0	0	0	1	0	16	5
Helena	0	0	0	0	0	0	0	0	0	0	2
Missoula	0	0	0	0	0	0	0	0	0	0	7
Idaho:											
Boise	0	0	0	3	0	0	0	0	0	2	2
Colorado:											
Denver	11	12	0	0	0	5	0	0	0	26	78
Pueblo	0	0	0	0	0	1	1	1	0	6	3
New Mexico:											
Albuquerque	1	0	0	0	0	3	0	0	0	0	8
Arizona:											
Phoenix	0	0	1	0	0	0	0	0	0	0	----
Utah:											
Salt Lake City	2	3	1	0	0	1	0	0	0	28	40
Nevada:											
Reno	0	0	0	0	0	0	0	0	0	0	4
PACIFIC											
Washington:											
Seattle	7	11	1	0	----	----	0	1	----	55	----
Spokane	5	0	5	6	----	----	0	0	----	2	----
Tacoma	3	1	3	0	0	2	0	0	0	8	25
Oregon:											
Portland	3	1	9	5	0	0	0	0	0	3	70
Salem	0	1	0	0	0	0	0	0	0	0	----
California:											
Los Angeles	28	36	5	0	0	18	1	0	0	34	----
Sacramento	2	2	1	0	0	2	1	0	0	12	19
San Francisco	20	6	0	0	0	7	0	0	0	18	124

City reports for week ended May 30, 1931—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases estimated expectancy	Cases	Deaths
NEW ENGLAND									
Massachusetts:									
Boston	0	0	0	0	0	0	1	1	0
MIDDLE ATLANTIC									
New York:									
New York	4	0	3	0	0	0	1	2	0
Syracuse	2	0	0	0	0	0	0	0	0
New Jersey:									
Newark	3	1	0	0	0	0	0	0	0
Pennsylvania:									
Philadelphia	2	1	0	0	0	0	0	0	0
Pittsburgh	1	1	0	0	0	0	0	0	0
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	0	1	0	0	0	0	0	0	0
Cleveland	1	2	1	0	0	0	0	1	0
Columbus	1	1	1	1	0	0	0	0	0
Indiana:									
Indianapolis	2	1	0	0	0	0	0	0	0
Illinois: [1]									
Chicago	9	4	0	0	0	0	0	0	0
Michigan:									
Detroit	2	0	0	0	0	0	0	0	0
Grand Rapids	1	0	0	0	0	0	0	0	0
WEST NORTH CENTRAL									
Minnesota:									
Duluth	1	0	0	0	0	0	0	0	0
St. Paul	0	0	0	0	0	0	0	2	0
Iowa:									
Waterloo	0	0	0	0	0	0	0	1	0
Missouri:									
St. Louis	3	2	0	0	0	0	0	0	0
Nebraska:									
Omaha	2	0	0	0	0	0	0	0	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	3	0	0	0	0	0	0	0	0
District of Columbia:									
Washington	2	1	0	0	0	0	0	0	0
Virginia:									
Roanoke	0	0	0	0	0	1	0	0	0
West Virginia:									
Charleston	1	1	0	0	0	0	0	0	0
Wheeling	0	0	0	0	0	0	0	1	0
North Carolina:									
Wilmington	0	0	0	0	1	0	0	0	0
Winston-Salem	0	0	0	0	1	0	0	0	0
South Carolina:									
Charleston	1	1	0	0	5	1	0	0	0
Columbia	3	0	0	0	0	0	0	0	0
Georgia:									
Atlanta	0	0	1	1	0	0	0	0	0
Brunswick	0	0	0	0	1	0	0	0	0
Savannah	0	0	0	0	1	1	0	0	0
Florida:									
Tampa	0	1	0	0	0	1	0	0	0

[1] Rabies (in man); 1 death at Springfield, Ill.

City reports for week ended May 30, 1931—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases estimated expectancy	Cases	Deaths
EAST SOUTH CENTRAL									
Tennessee:									
Memphis	0	0	0	0	0	2	0	0	0
Nashville	1	0	0	0	0	0	0	0	0
Alabama:									
Birmingham	0	0	0	0	1	2	0	0	0
Mobile	0	0	0	0	3	0	0	0	0
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans	1	1	0	0	0	0	0	0	0
Oklahoma:									
Oklahoma City	1	0	0	0	0	0	0	0	0
Texas:									
Dallas	1	0	0	0	2	1	0	0	0
MOUNTAIN									
Montana:									
Great Falls	0	1	0	0	0	0	0	0	0
Colorado:									
Pueblo	1	0	0	0	0	0	0	0	0
New Mexico:									
Albuquerque	0	0	0	0	1	1	0	0	0
Utah:									
Salt Lake City	2	0	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Tacoma	1	1	0	0	0	0	0	0	0
California:									
Los Angeles	0	0	0	0	0	1	0	0	0

The following tables give the rates per 100,000 population for 98 cities for the 5-week period ended May 30, 1931, compared with those for a like period ended May 31, 1930. The population figures used in computing the rates are estimated midyear populations for 1930 and 1931, respectively, derived from the 1930 census. The 98 cities reporting cases have an estimated aggregate population of more than 33,000,000. The 91 cities reporting deaths have more than 31,500,000 estimated population.

Summary of weekly reports from cities, April 26 to May 30, 1931—Annual rates per 100,000 population, compared with rates for the corresponding period of 1930 [1]

DIPHTHERIA CASE RATES

	Week ended—									
	May 2, 1931	May 3, 1930	May 9, 1931	May 10, 1930	May 16, 1931	May 17, 1930	May 23, 1931	May 24, 1930	May 30, 1931	May 31, 1930
98 cities	63	83	[2] 67	77	63	74	62	79	[2] 59	76
New England	36	82	[4] 35	65	38	106	48	68	50	56
Middle Atlantic	61	72	61	85	58	74	63	76	58	67
East North Central	84	130	82	103	72	91	67	115	[3] 82	110
West North Central	57	68	71	45	71	74	75	72	54	77
South Atlantic	69	50	63	62	55	54	38	54	41	60
East South Central	6	0	41	6	17	36	12	24	17	36
West South Central	68	94	108	73	81	66	81	52	54	49
Mountain	26	44	[5] 28	70	61	35	61	53	52	44
Pacific	53	61	61	49	74	43	72	59	37	67

MEASLES CASE RATES

98 cities	1,250	1,293	[2] 1,308	1,411	1,403	1,255	1,372	1,159	[2] 1,116	911
New England	964	1,942	[4] 1,103	2,303	1,166	1,843	1,190	1,877	935	1,558
Middle Atlantic	1,411	1,284	1,433	1,295	1,486	1,337	1,478	1,091	1,187	940
East North Central	897	1,005	1,102	927	1,313	814	1,458	685	[3] 1,312	524
West North Central	777	1,003	1,016	1,269	1,396	831	1,098	794	641	525
South Atlantic	3,871	1,188	3,553	1,298	3,365	1,228	2,840	957	2,089	793
East South Central	1,426	185	1,263	442	1,234	359	1,234	568	1,047	335
West South Central	156	731	152	711	166	735	271	547	294	453
Mountain	661	5,912	[5] 576	9,128	531	6,652	618	7,119	461	5,674
Pacific	505	1,773	501	1,992	554	1,670	456	2,180	492	1,397

SCARLET FEVER CASE RATES

98 cities	368	296	[2] 390	258	389	226	367	206	[2] 306	182
New England	582	268	[4] 631	310	666	261	536	314	351	307
Middle Atlantic	409	285	448	266	439	222	442	204	304	162
East North Central	402	394	439	318	454	308	412	227	[3] 440	264
West North Central	480	384	440	238	383	262	340	306	291	213
South Atlantic	273	294	276	242	243	172	241	164	239	126
East South Central	407	132	250	138	337	24	390	102	297	72
West South Central	132	115	105	94	108	73	85	49	51	14
Mountain	191	361	[5] 177	370	157	229	270	300	165	97
Pacific	94	109	106	130	123	128	88	97	110	71

SMALLPOX CASE RATES

98 cities	27	27	[2] 15	24	17	22	16	20	[2] 15	15
New England	0	0	[4] 0	2	0	0	0	0	0	0
Middle Atlantic	1	1	3	0	1	0	4	0	1	1
East North Central	10	21	6	22	23	16	15	10	[3] 8	12
West North Central	125	132	78	101	75	126	67	110	88	56
South Atlantic	6	0	8	0	6	4	6	2	24	10
East South Central	58	36	41	6	12	72	41	30	6	30
West South Central	101	31	64	38	41	21	47	10	37	14
Mountain	0	150	[5] 0	79	17	62	9	70	26	62
Pacific	51	73	12	83	25	47	12	71	12	49

[1] The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1931, and 1930, respectively.
[2] Pawtucket, R. I., Billings, Mont., and Boise, Idaho, not included.
[3] South Bend, Ind., not included.
[4] Pawtucket, R. I., not included.
[5] Billings, Mont., and Boise, Idaho, not included.

Summary of weekly reports from cities, April 26 to May 30, 1931—Annual rates per 100,000 population, compared with rates for the corresponding period of 1930—Continued

TYPHOID FEVER CASE RATES

	Week ended—									
	May 2, 1931	May 3, 1930	May 9, 1931	May 10, 1930	May 16, 1931	May 17, 1930	May 23, 1931	May 24, 1930	May 30, 1931	May 31, 1930
98 cities	6	6	[3]5	6	5	8	6	7	[3]7	7
New England	7	2	[4]5	0	5	10	2	19	2	12
Middle Atlantic	7	3	5	4	5	7	5	4	8	3
East North Central	4	6	2	2	2	2	5	5	[3]2	2
West North Central	4	4	2	8	6	8	10	8	4	10
South Atlantic	14	6	8	16	12	14	12	12	22	14
East South Central	12	24	6	18	17	42	17	24	12	36
West South Central	0	21	7	3	7	35	7	10	7	21
Mountain	0	53	[5]0	18	0	0	0	0	17	9
Pacific	6	6	8	20	0	2	8	6	2	8

INFLUENZA DEATH RATES

91 cities	11	9	[3]12	9	8	8	7	6	[3]7	4
New England	7	5	[4]5	10	2	0	5	5	10	0
Middle Atlantic	12	9	11	10	7	7	5	7	3	4
East North Central	5	7	11	9	5	4	5	5	[3]6	4
West North Central	12	9	6	3	9	3	3	0	9	3
South Atlantic	20	16	22	6	16	20	4	6	18	4
East South Central	19	19	50	13	50	39	19	19	19	32
West South Central	38	21	14	28	7	4	28	7	14	4
Mountain	26	0	[5]28	0	9	9	26	9	17	18
Pacific	2	5	7	7	7	12	0	5	5	2

PNEUMONIA DEATH RATES

91 cities	121	135	[3]117	133	102	102	95	101	[3]101	78
New England	154	164	[4]135	131	113	111	72	109	111	97
Middle Atlantic	141	163	144	176	121	124	121	130	109	89
East North Central	77	107	87	92	74	67	68	79	[3]76	53
West North Central	180	114	121	126	103	108	97	84	133	69
South Atlantic	180	204	130	132	126	170	111	110	132	90
East South Central	120	123	120	142	126	84	120	78	183	97
West South Central	152	110	114	164	114	78	97	82	128	121
Mountain	61	62	[5]102	123	78	79	70	123	70	79
Pacific	46	42	70	52	55	47	55	35	43	52

[3] Pawtucket, R. I., Billings, Mont., and Boise, Idaho, not included.
[4] South Bend, Ind., not included.
[4] Pawtucket, R. I., not included.
[5] Billings, Mont., and Boise, Idaho, not included.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Week ended May 23, 1931.—The Department of Pensions and National Health of Canada reports cases of certain communicable diseases for the week ended May 23, 1931, as follows:

Province	Cerebro-spinal fever	Influenza	Poliomy-elitis	Smallpox	Typhoid fever
Prince Edward Island [1]					
Nova Scotia [1]					
New Brunswick					2
Quebec	2		1		6
Ontario	1	1	1		2
Manitoba					3
Saskatchewan	1	6		18	
Alberta			1		1
British Columbia		8			2
Total	4	15	3	18	16

[1] No case of any disease included in the table was reported during the week.

Quebec Province—Communicable diseases—Week ended May 30, 1931.—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the week ended May 30, 1931, as follows:

Disease	Cases	Disease	Cases
Chicken pox	94	Mumps	10
Diphtheria	14	Scarlet fever	60
Erysipelas	5	Tuberculosis	105
German measles	4	Typhoid fever	2
Measles	469	Whooping cough	11

CUBA

Habana—Communicable diseases—Four weeks ended May 23, 1931.—During the four weeks ended May 23, 1931, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Chicken pox	43		Measles	86	1
Diphtheria	20	2	Scarlet fever	11	
Leprosy	3		Tuberculosis	26	1
Malaria [1]	5		Typhoid fever [1]	15	4

[1] Many of these cases are from the Island of Cuba, outside of Habana.

DENMARK

Communicable diseases—March, 1931.—During the month of March, 1931, cases of certain communicable diseases were reported in Denmark, as follows:

Disease	Cases	Disease	Cases
Anthrax	2	Paratyphoid fever	5
Cerebrospinal meningitis	2	Puerperal fever	21
Chicken pox	37	Scabies	812
Diphtheria and croup	349	Scarlet fever	192
Erysipelas	243	Syphilis	146
German measles	3	Tetanus	1
Influenza	22,829	Typhoid fever	4
Lethargic encephalitis	7	Undulant fever (Bac. abort. Bang)	58
Measles	1,241	Whooping cough	1,554
Mumps	519		

GREAT BRITAIN

England and Wales—Vital statistics—January–March, 1931.—During the first quarter of the year 1931, 159,820 births and 162,198 deaths were registered in England and Wales, giving a birth rate on an annual basis of 16.3 per 1,000 population and a death rate of 16.5 per 1,000. The figures are provisional. The mortality of infants under 1 year of age was 94 per 1,000 live births.

During the 13 weeks ended April 4, 1931, deaths from certain communicable diseases were reported in 107 county boroughs and great towns, including Greater London, as follows:

Disease	Number of deaths	Death rate per 1,000 population	Disease	Number of deaths	Death rate per 1,000 population
Diarrhea and enteritis (under 2 years)	789		Scarlet fever	92	0.02
Diphtheria	508	0.10	Smallpox	1	
Influenza	4,403	.90	Typhoid fever	24	
Measles	984	.20	Whooping cough	574	.12

Deaths from certain communicable diseases in 159 smaller towns for the quarter ended March 31, 1931, were as follows:

Disease	Deaths	Disease	Deaths
Diarrhea and enteritis (under 2 years)	99	Scarlet fever	25
Diphtheria	107	Typhoid fever	6
Influenza	1,261	Whooping cough	110
Measles	161		

England and Wales—Communicable diseases—Thirteen weeks ended April 4, 1931.—During the 13 weeks ended April 4, 1931, cases of certain communicable diseases were reported in England and Wales as follows:

Disease	Cases	Diseases	Cases
Diphtheria	15,488	Puerperal pyrexia	1,626
Ophthalmia neonatorum	1,223	Scarlet fever	21,088
Pneumonia	28,000	Smallpox	2,921
Puerperal fever	662	Typhoid fever	607

JAMAICA

Communicable diseases—Four weeks ended May 23, 1931.—During the four weeks ended May 23, 1931, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island of Jamaica, outside of Kingston as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Cerebrospinal meningitis		3	Leprosy		3
Chicken pox	1	52	Puerperal fever		4
Diphtheria		1	Scarlet fever	4	10
Dysentery		2	Tuberculosis	35	80
Erysipelas		2	Typhoid fever	6	38

TRINIDAD

Port of Spain—Vital statistics—April 1930, 1931.—The following statistics for the month of April, 1930 and 1931, are taken from a report issued by the public health department of Port of Spain, Trinidad:

	April			April	
	1930	1931		1930	1931
Number of births	171	170	Death rate per 1,000 population	19.7	19.3
Birth rate per 1,000 population	30.9	30.1	Deaths under 1 year	12	19
Number of deaths	109	109	Deaths under 1 year per 1,000 births	70.2	111.8

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Hygiene, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths; P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931			April, 1931				May, 1931					June 6, 1931
						14	21	28	4	11	18	25	2	9	16	23	30	
Ceylon: Colombo	C					1											1	
China: Canton	C									1						2		
	D															1		
India	C	11,112	10,687	15,334	11,544	2,471	857	2,551	2,989	3,161								
	D	5,933	5,689	8,123	6,131	1,252	473	1,314	1,511	1,571								
Bombay	C	13		21						2								
	D	7		9						1								
Calcutta	C	22	28	121	170	80	102	129	125	95	82	62	71		89	49		
	D	16	20	86	112	49	68	69	70	55	51	26	44		44	24		
Karikal	C		1		9	2	1	7	2	10	8	1		10			1	
	D				8	2	1	7	2	5	8	1		5			1	
Madras	C		201	99	72	4	5	7	4	3	1	4	18	18	23	11		
	D		67	47	29	5	3	2		5	1	3	5	6	8	2		
Negapatam	D			3	3													
Rangoon	C		1														2	
	D		1	1													1	
Tuticorin	C	5	1	1	1													
India (French):																		
Chandernagor	C	1	2	1	5	2	2	2	1	3	2	1		3		1		
	D		3	1	5	2	3	1		3	2			3		1		
Pondicherry	C	4	31	19	100	29	25	26	20	5	3	5	11	3	8	2		
	D	4	21	11	34	6	5	4	3	1	3							
India (Portuguese)	C		1															
Indo-China (see also table below):																		
Pnompenh	C	2		4	9					1	1							
	D	2		2	5		1					1		2				
Saigon and Cholon	C	3	9	6	4	1		1	3	2	3	7	15	25	23	34		
	D	1	4	3	4	2	1	1	1		3	6	13	20	18	25		
Persia: Rafsandjan	C													31				
	D													12				

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

CHOLERA—Continued

[C indicates cases; D, deaths; P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931 14	21	28	April, 1931 4	11	18	25	May, 1931 2	9	16	23	30	June 6, 1931
Philippine Islands:[1]																		
Iloilo	C	1	1	2														
	D	3	1	2														
Provinces—																		
Capiz	C			59	186	29	11	4	4		3	8	18	11	3		3	4
	D			47	146	24	10	4	3		3	8	13	11	3		1	4
Iloilo	C	45	28	145	95	2	5											8
	D	27	22	110	65	2	2											6
Masbate	C					21												
	D					9												
Negros, Occidental	C	163	120	90	4													
	D	123	97	56	4													
Negros, Oriental	C			1														
	D			1														
Pampanga	C													1				
Samar	C	8	17															
	D	8	9															
Siam	C	6	2	3	1		4	4	2	1	1	1	13	11				
	D	6	2	1			1	1					4	3				
Ayudhaya District	C								1									
Bangkok	C	4	2	3	2		1	1	1	1		1	1	1	1	1		
	D	4	2	1	1		1	1				1	1			1		
Bismulok Province	C						4	4										
	D						1	1										

Place		October, 1930	November, 1930	December, 1930 1–10	11–20	21–31	January, 1931 1–10	11–20	21–31	February, 1931 1–10	11–20	21–28	March, 1931 1–10	11–20	21–31
Indo-China (French) (see also table above):															
Cambodia[2]	C	22	26	28			7	19	36	71	35	19	14		65
Cochin-China[2]	C	28	13	8			7	4	13	5	5	19	39		33

[1] Figures for cholera in the Philippine Islands are subject to correction.

[2] Reports incomplete.

PLAGUE

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931			April, 1931				May, 1931				
						14	21	28	4	11	18	25	2	9	16	23	30
Algeria:																	
Algiers	C	2	1	2	1				1								
	D								1								
Bone	C			1													
Constantine, vicinity of	C		50	1	1												
	D			1													
Philippeville	C		1														
	D		1														
Argentina:																	
Cordoba Province	C			1	2												
Entre Rios Province—Diamante	C				2												
Jujuy Province—Palpala	C			1	1												
Santa Fe	C				2												
Belgian Congo	C	1					2										
	D	1					2										
British East Africa (see also table below):																	
Tanganyika	C	3	2		22		8					3			5		
	D	3	2		4		1					10			2		
Uganda	C	111	67	25	15	4	7	4	4	8	3						
	D	112	67	24	15	4	7	4	4	8	3						
Ceylon: Colombo	C	9	9	8	11	1	3	3	1	1	3			1			
	D	8	9	6	13	1	3	2	1	1	2			1		5	
Plague-infected rats		2		2	3		3	1			1						
China: Amoy	C													1			
	D													1			
Dutch East Indies:																	
Batavia and West Java	C	208	239	180	141	18	31	23	12	19	24						
	D	206	238	168	128	17	28	23	12	18	23						
East Java and Madura	C			4	1	1		1	2								
	D			4	1	1		1	2								
Java and Madura	D	557	615	427	376	65	81	68	63	58	73	70	42				
Egypt:																	
Alexandria	C	4	3	1	2	1											
	D	1															
Plague-infected rats		3	1	1	1												
Assiout	C	9	7	26	41	6	10	1	1	5	16	8	3	4	5	8	1
	D	1	1	6	11		4	1	1		11	4	2	2	4	1	
Aswan	C	3															

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

[C indicates cases; D, deaths; P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931			April, 1931				May, 1931				
						14	21	28	4	11	18	25	2	9	16	23	30
Egypt—Continued.																	
Beni-Suef	C			1								10	2	3		2	
	D			1								3		1		2	
Cairo	C								1				3	7	1		2
Deirout	C			21	16								1	2	2		
	D			4	4												
Gharbieh	C			1													
	D			1													
Girga	C		7	1			14	37	35	31	9	4	1	1	1	5	
	D		2	1			2	5	17	13	3	5	1	1	1		
Kena	C							5				3				1	
	D							2				1				1	
Manfalut	C		23	30	15	3	5	9									
	D		5	6	5		2	1			1			5		1	
Minieh	C	1		2			2	1						2		1	
	D			1			1	1								1	
Hawaii Territory: Hamakua—Plague-infected rats																	
India	C	3,259	3,740	5,335	5,457	2,674	2,271	2,462	1,732	2,503							
	D	1,856	2,226	3,422	3,661	1,887	1,624	2,009	1,526	1,980			1			1	
Bassein	C		2	4	1								1			1	
	D		1	3	1								2	5		1	
Bombay	C			1	1	1	1	1	1	4	4	1	3	4	1	1	
	D			1	1		2	1		4	4						
Plague-infected rats		32	38	34	32	17	14	21	18	34	43	30	30	26	30	17	
Calcutta	C									1	1						
	D									1	1						
Madras Presidency	C	148	220	312	74	9	12	7		3							
	D	78	154	182	46	4	12	5		2							
Rangoon	C		2	2				1		1				1			
	D		1	1				1		1				1	1	3	
Plague-infected rats		4	2	4	8				1	1	3						
Indo-China (see also table below): Pnompenh	C	6	1	7	1												
	D	6	1	7	4	2	1	1	2	2	1	1					
Iraq: Baghdad	C	4		5	3	1	3	3	1		5	10	8	7	10	4	2
	D	2		4	2		3	1	1		2	5	1	3	4	2	

Madagascar (see also table below): Tamatave	C	4	2	9													
	D	3															
Morocco	C		19	13													
	D		8	4													
Nigeria: Lagos	C	9	5	1						2	2	1					
	D	9	5	1						2	2	1					
Plague-infected rats		5	5							3	3						
Peru (see table below).																	
Senegal (see table below).																	
Siam	C			4	18	2	2			1							
	D			2	14	1	1			1							
Bangkok	C	1	3	8	6	29											
	D	1	3	8	5	6											
Nagara Rajsima	C	11	17	9	7			1									
	D	9	10	10	6												
Syria: Beirut	C		1	1	1												
Tripolitania	C	13		8	1	1											
	D	1		3													
Tunisia: Tunis	C	P	13	1	14		5		5	5	7		4			1	
	D				7				4	4	2		2				
Union of Socialist Soviet Republics:																	
Gourandux	D			28													
Transcaucasia—Karabakh	C			6													
Union of South Africa:																	
Cape Province	C	P							2	1							
Orange Free State	C		2	P	1	2		4	P	1	1						
	D		2		1			1		1	1						
On vessel: S. S. Marionga de Thermiotis at Avonmouth	C		1														

Place		Nov., 1930	Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931
British East Africa (see also table above):							
Kenya	C	62	50	69	21	7	12
Indo-China (see also table above)	C	5	1			4	2
Madagascar (see also table above):							
Ambositra Province	C	44	95	100	92	70	
	D	44	87	96	88	66	
Antisirabe Province	C	18	27	66	84	83	
	D	18	26	57	79	74	
Miarinarivo Province	C	12	18	28	31	19	
	D	12	18	26	29	19	
Moramanga Province	C	19	13	7	7	1	
	D	19	11	5	7	1	
Tananarive Province	C	170	178	92	145	90	
	D	164	172	89	139	81	

Place		Nov., 1930	Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931
Peru	C	34	41	29	12		
	D	14	13	8	6		
Senegal:							
Baol [1]	D	4					
Dakar [1]	C						2
	D						1
Louga [1]	C	10				14	1
	D	3				6	
Rufisque [1]	C				2		
Thies [1]	C	27	2				
	D	23	1				
Tivaouane [1]	C	21	2				4
	D	25	1				

[1] Reports incomplete.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX

[C indicates cases; D, deaths; P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931 14	21	28	April, 1931 4	11	18	25	May, 1931 2	9	16	23	30
Algeria:																	
Algiers	C		1	1	1			2			2						
Bone	C			1			1							1			
Constantine	C																
Oran	C	3															
Arabia: Aden	C			1	1												
Belgian Congo	C		79	50													
Belgium	C				1												
Brazil: Porto Alegre (alastrim)	C	36		3	7	7	12	16	14	20	19	8	6				
	D				1				1								
British East Africa (see also table below): Tanganyika	C	385	84	70	91	6	2										
	D	36	4	5	13	1	2										
British South Africa: Southern Rhodesia	C	18	18	13													
	D	3															
Canada:																	
Alberta	C	1	19	7	1												
British Columbia	C	1	3	2	8												
Manitoba	C			1	1									4			
Winnipeg	C		1		1												
Nova Scotia	C			1				1									
Ontario	C	23	17	49	29	2	3	3	1	4		6	7	17	5		
Kingston	C		6	1	1							2	3				
North Bay	C		2		1												
Ottawa	C	12	2	3	1					3	1				1		
Sault Ste. Marie	C		1	30	2						4			1			
Toronto	C	4				1		1									
Quebec	C	2		2													
Saskatchewan	C	18		38	63	40	10	8		5	16	3	22	7	15	18	
Regina	C				1			2				2		2			
Canary Islands: Las Palmas	C							1									
China:																	
Amoy	C							1					2	2			
	D							1					1	1			
Canton	C				3	1	2	2	2	1	2	1				1	
Chungking	C	P	2														

Foochow	C	P	P	P	P		P		P	P							
Hong Kong	C		1	1	9			1	1		1	2					
	D				3			2				1		1			
Manchuria—																	
Harbin	C			1	4	1		1									
Kwantung—Dairen	C	4	1					2				1	1				
	D	1															
Nanking	C	P	P	P	P		P	P	P	P	P	P	P				
Shanghai—																	
Foreigners only	C	8	14	12	16	3	1	1	1	2	1	2	2	1	4	1	
Including natives	D	4	11	13	14	5	2	2	1	2	7	4	5	1		3	
Swatow	D	3	5	7	13	3	6	9	8	2							
Tientsin	C	2		1													
Chosen (see table below).																	
Colombia: Cali	D	1												1			
Dutch East Indies: Java—Batavia and West Java	C	6	4	29	2	1											
	D	2	2	2	1												
France (see table below).																	
Great Britain:																	
England and Wales	C	508	665	958	745	171	219	226	179	177	163	212	192	186	166	111	
Bradford	C	1	1	4	1		1		1	1		1	4	1	3	1	
Leeds	C		2						1		1	1		1		1	
London	C	184	161	149	98	26	54	32	35	51	39	84	53	66	44	37	
London and Great Towns	C	433	560	693	683	117	154	166	117	142	126	162	128	139	108	84	
	D	1			1							1					
Sheffield	C			3	32	2	1	6	1	4	2	1					
Stoke-on-Trent	C			1	1												
Greece (see table below).																	
Honduras:																	
Amapala	C				1												
Ocotopeque and Gracias districts	C				P												
Puerto Castilla	C		4	11	3												
Tegucigalpa	C											1					
Tela	C										1						
India	C	3,627	5,623	9,623	12,222	3,440	1,695	3,395	3,261	3,980							
	D	874	1,381	2,245	2,660	655	303	655	638	807							
Bombay	C	1	2	7	6	4	1	4	1	2	2	1	3	3		6	
	D	1	2	1	3		1	2	1	1			4	1	1	1	
Calcutta	C	18	59	143	251	53	69	75	86	101	60	61	65	24	30	19	
	D	11	40	100	188	36	54	50	63	78	42	50	54	18	25	17	
Cochin	C	22	15	29	59	15	17	14		10	11	12	6	3			
	D	4	1		3												
Karachi	C	3		3	4		3		1		5		1				
	D	1		2				2									
Madras	C	20	4	16	8	6	3	9	4	12	4	1	2	1	3	3	
	D	3			1		2	1		2	1	1	1		1	5	
Moulmein	C			2													
Negapatam	C	6								1	1		1				
Rangoon	C	1			4	1	1	1		2	2	1	6	7	5		
	D					1							1	2	1	1	
Vizagapatam	C			1	8	1		1		2	2	4	2			5	
	D				2			1		1		1				1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

[C indicates cases; D, deaths; P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931 14	21	28	April, 1931 4	11	18	25	May, 1931 2	9	16	23	30
India (French):																	
Chandernagor	C		5	9	12	3	3	6	2	3	1			3		4	
	D		3	1	1				2	3	1			3		2	
Karikal	C		3	5	19			3			1	1	2	1		1	
	D		2	4	18						1		2	1			
Pondicherry Province	C	19	34	45	19	7		4	3	3			3	1	2	7	
	D	17	32	45	19	7		4	3	3	3		3	1	2	7	
India (Portuguese)	C		4	5	14		3	5			19	2					
	D				3		1	2			4	2					
Indo-China (see also table below):																	
Pnompenh	C	1	2	1		1										1	
	D	1		1													
Saigon and Cholon	C	2		6	4	4	1	1	2	1					1		
	D	2		4	1	3	1	2	2	1					1		
Iraq:																	
Baghdad	C				9							1	1				
Mosul Liwa	C	16	1	3	5												
	D	2			1												
Ivory Coast (see table below).																	
Japan:																	
Kobe	C				2												
Taiwan	C			1													
Mexico (see also table below):																	
Jalisco (State)—Guadalajara	D	3		1				1					1	1		1	
Mexico City and surrounding territory	C	6	10		23	13	13	7		17	9	11	6	4	10		
	D	6	6	1	8	5	5	6	6	4	6	4		4	3		
Torreon	C										1				1		
	D										2						
Vera Cruz	C				3		1	1			1		1	1			
Morocco (see table below).																	
Nicaragua: Porto Cabezas	C		2														
Nigeria: Lagos	C							2									
Panama Canal Zone	C			2													
Poland	C	3	25		1												
Portugal: Lisbon	C	37	72	103	40	16	15	17	4	8	18	11	19	19			
Siam	C		1	4	2							1					
Somaliland, British: Boales	C	1															
	D		1														
Spain	C	P	P	P	P	P	P	P									

Straits Settlements	C	17	6	7	2			2	1	1		1					
	D	7	3	1	1			1		1	1						
Sudan (Anglo-Egyptian)	C	50	64	11	97	3	1	4					3		3		1
	D	5	6	7	10		1	1									
Sudan (French) (see table below).																	
Syria (see table below).																	
Tunisia: Tunis	C		17	8				4									
Turkey (see table below).																	
Union of South Africa:																	
Cape Province	C	P	P	P	P			P	P	P	P						
Orange Free State	C	P		P	P			P	P	P	P						
Transvaal	C	P	P	P	P	P		P									
Upper Volta	C	6	4		18			3			3			1			
	D		2					1									
On vessel:																	
S. S. Clan Mactoggart at Suez	C				2												
S. S. Muncaster Castle at Manila from Hong Kong	C		1														
S. S. Matheran at Suez from Calcutta	C			1													
S. S. Clan Buchanan at Suez	C				2												
S. S. Rotterdam at Naples from Venice	C							1			1						
S. S. Clan McTavish at Manila from Chittagong	C																
S. S. Benvenue at Sydney from Shanghai	C			1													
S. S. Clan MacBrayne at Cochin	C				1												
S. S. Chilka at Rangoon	C				1												
S. S. Taif (pilgrim ship) at Suakin from Jeddah	C												1		1		
S. S. Talodi at Soakim	C																

Place		Nov., 1930	Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931
British East Africa (see also table above):							
Kenya	C	653					
Chosen	C			1		11	
	D			1		3	
France	C			4	16		

Place		Nov., 1930	Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931
Greece	C		4		4		
Mexico (see also table above)	D		1		8		1
Morocco	C	20	25		4	6	7
Turkey	C	65	116		37	1	
	D	1	9		6		

Place		October, 1930	November, 1930	December, 1930			January, 1931			February, 1931			March, 1931		
				1-10	11-20	21-31	1-10	11-20	21-31	1-10	11-20	21-28	1-10	11-20	21-31
Indo-China (see also table above)	C	258	86	38	9	14	47	48	46	95	46	27	125		139
Ivory Coast	C	4	2	9									4		P
Sudan (French)	C	17		43		96									
	D	2		16		4									
Syria: Beirut	C							1							

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER

[C indicates cases; D, deaths, P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Week ended— March, 1931 14	21	28	April, 1931 4	11	18	25	May, 1931 2	9	16	23	30
Algeria:																	
Algiers	C	2			2			3				2	1	3			
	D																
Constantine Department	C	2	6	31	4		1		2	2		6	1	8	3		
	D																
Oran	C	5		3	1				1			1		1			
	D																
Australia, Western	C		3						9		26	4					
	D																
Bulgaria	C	11	1	13	5				2		3						
	D						1										
Chile: Valparaiso	C																
	D																
China:																	
Canton	C			2		1											
	D											8					
Manchuria—Harbin	C	1		3	5			3									
	D																
Shanghai	C			2						1	1						
	D																
Tientsin	C	1															
	D																
Chosen (see table below).																	
Czechoslovakia (see table below).																	
Egypt:																	
Alexandria	C	2									1						
	D											1					
	P									3	1						
Behaira Province	C		1							2							
	D		1														
	P																
Cairo	C	1	1	1													
	D			1													
Port Said	C					1											
	D																
Eritrea: Asmara	C																
	D																
Great Britain: Scotland	C			1													
	D			2													
Glasgow	C																
	D			1													
Greece (see table below).																	
Guatemala.[1]																	
Iraq: Baghdad	C				5	1								2			
	D				1									1			

Irish Free State:																
Kerry County—Dingle	C												1			
Mayo County—Belmullet	C									1						
Latvia (see table below).																
Lithuania (see table below).																
Mexico (see also table below):																
Durango	D			1												
Mexico City, including municipalities in Federal District	C	14	12	39	35	46	66	73	31	67	34	38	31	16	27	
	D	7	10	34	16	20	13	31	20	18	7	17	14	9	7	
San Luis Potosi	D	2			5	1	1	2	1	1	2				1	1
Morocco	C	1	8	8	28	2	2	3			1		12		13	
	D			2	1								1		2	
Palestine	C	7	4	2	3	2	1	1	1	1	2		2	2	1	1
Panama Canal Zone—Balboa	C														1	
Paraguay: Asuncion	D			4												
Poland	C	42	63	106	189	62	58	85	82	93	176	140	129	92	81	
	D	7	3	8	19	4		7	4	8	7	6	7	6	4	
Portugal: Oporto	C	6		1												
Rumania	C	34	113	193	152	55	53	52	54	70						
	D	3	5	16	24	4	5	3	4	8						
Spain	C	1														
	D	1														
Syria	C													1	3	
Tunisia:																
Sbeitla, vicinity of	C								20	2			10			
	D								7							
Sfax	C							2								
Tunis	C	28		16	18	5	2	7		2			10		9	8
Turkey (see table below).																
Union of South Africa:																
Cape Province	C	P	P	P	P	1		P	P	P	P	P				
Municipality of East London	C	1	3	3				P	P							
Natal	C		P	P	P		1	P	P	P	P	P				
Orange Free State	C		P	P	P	P				P	P	P				
Transvaal	C	P	P	P	P	P		P	P	P	P	P				
Yugoslavia (see table below).																

Place		Nov., 1930	Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931
Chosen: Seoul	C	1	1	1		3	
Czechoslovakia	C	16	24	60	26		
Greece	C	4	10	10	17	8	
	D			2	2	1	
Latvia	C				12		

Place		Nov., 1930	Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931
Lithuania	C	5	6	26	3	22	32
	D	1	3	3	1	2	3
Mexico (see also table above)	D	47	47				
Turkey	C	3	2		18		
Yugoslavia	C	2	1	20	12	10	43
	D		1	2		1	5

[1] On Feb. 27, 1931, the Director General of Public Health of Guatemala reports an unusual outbreak of typhus fever in a small village in Guatemala.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

YELLOW FEVER

[C indicates cases, D, deaths; P, present]

Place		Nov. 16–Dec. 13, 1930	Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Week ended— February, 1931 14	21	28	March, 1931 7	14	21	28	April, 1931 4	11	18	25	May, 1931 2	9	16	23
Brazil:																			
Bahia State	C								1	1						2		1	
	D								2							2		1	
Ceara State	C			1															
	D			1						2			1		2	2	1		1
Minas Geraes State	C														1	1	1		
	D									1								1	1
Rio de Janeiro State	C							1	1	1									
	D							1	1										
Cambucy	C			3	1														
	D			3	1														
Friburgo (imported)	C			1															
	D																		
Padua	C			2	1														
	D			2	1													3	
British Cameroon: Mamfe	C																	1	
	D																		

×